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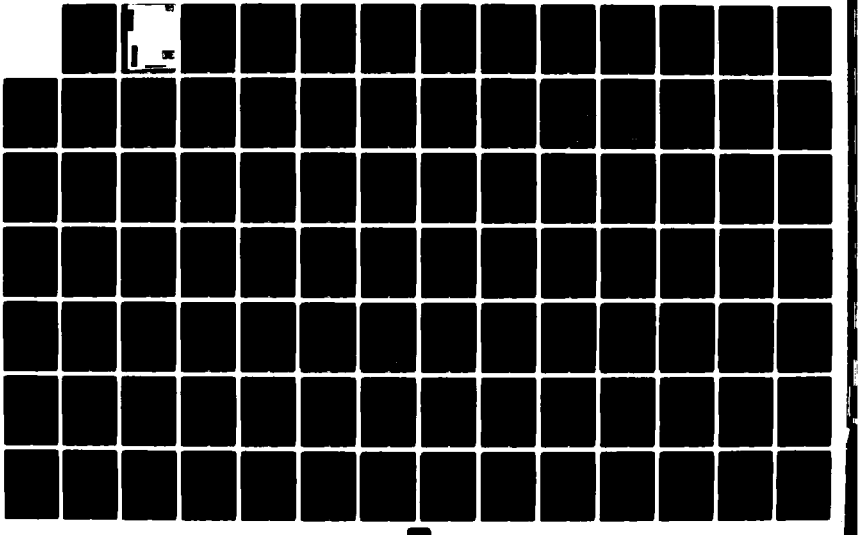

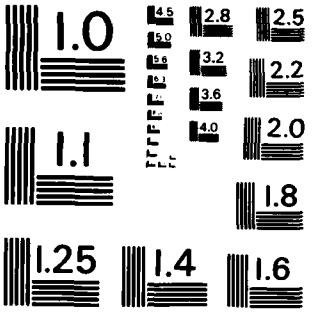

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

It is recommended that both the landward lock, the riverward lock and the dam at Lock & Dam no. 1, Minneapolis, Minnesota be completely rehabilitated. Based on studies completed to the date of this report, more detailed studies are required to firmly establish cost estimates, environmental effects, and the construction scheduling necessary to insure the work can be completed in the proposed two year construction period without delaying navigation. This appendix covers: environmental quality design; mechanical investigations;

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electrical features; the central control station and access bridge; coordination with other agencies, and a recreation user survey.

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1210 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER
STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO.1
MINNEAPOLIS,MINNESOTA

APPENDIX G
AESTHETIC AND ENVIRONMENTAL QUALITY DESIGN

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Appendix G

AESTHETIC AND ENVIRONMENTAL QUALITY DESIGN

Introduction

Landscaping requirements, present water quality, and the environmental effects of placing and removing cellular sheet pile cofferdams have been evaluated as part of the rehabilitation program for Lock & Dam No. 1 The evaluation has been based on photographs and maps, supplemented by environmental baseline data provided by the Corps of Engineers. This Appendix describes these requirements and conditions and the steps that may be taken to ensure enhancement and preservation of the project environment during and after the rehabilitation construction period.

Landscaping

A preliminary landscaping concept has been developed for the landward side of Lock & Dam No. 1. The plantings, and costs associated with those plantings, are assumed to be typical of site landscaping requirements, and generally applicable to all the proposed rehabilitation alternatives. A plan will be developed in Phase B that provides for plantings of trees, shrubs, and grass to enhance the view of the natural rock bluff to the west of the Lock and the Project facilities, including parking areas, control building, and the maintenance yard. Major planted areas around project features are shown on Plate G-1.

The Site. The area to be landscaped encompasses a portion of the site approximately 50 feet by 500 feet. Most of this area will be excavated to lower the existing grade by 10 feet. Five mature American elms (Ulmus americana) will be removed because of the lowered grade. These elms should be replaced by more tolerant, longer-lived species, which are less susceptible to disease.

Plantings. The American elm trees should be replaced by sugar maple (Acer saccharum,) and/or green ash (Fraxinus pennsylvanica, var. subintegerrima), both widely used shade trees which are fairly resistant to disease, long-lived, and quite colorful during the fall season. Replacement trees should be at least 5 inches in caliper and no less than 18 feet in height. The size of trees selected will depend on the results of further study of

the aesthetics, costs, availability, and survival of various sizes of trees of the species utilized.

It has been assumed for estimating purposes that approximately 30 shrubs will be utilized in the landscaping scheme. Typical shrubs selected for this purpose could include Pfitzer juniper (Juniperus chinensis, var. pfitzeriana), globe juniper (Juniperus virginiana, var. globosa), dwarf Japanese yew (Taxus cuspidata, var. nana) and Peking cotoneaster (Cotoneaster apiculata).

Turf removed during construction could be replaced, using a weed-free, two-inch thick, two-year old sod, grown in local nurseries. Alternatively, garden bark or gravel could be employed in areas now grass.

Cost. Landscaping is estimated to cost about $12,000 for trees, shrubs, and sod for the area shown on Plate G-1, as given in Table G-1. Specifications and unit prices of proposed planting are given in Table G-2.

Salvage of Existing Elms. Consideration was given to saving the existing elms. Procedures and costs were analyzed for removing, storing, and replanting existing trees. Preliminary estimates indicate that it would cost nearly $50,000 to remove, maintain during construction, and replant these trees. There is no guarantee that the trees would survive. The trees in their weakened condition would be more susceptible to disease, including the relatively common Dutch elm disease. Transplanting procedures for saving the five existing trees would be as follows:

1) At least one growing season prior to scheduled tree removal, a circular trench should be dug to a depth of three to four feet around each tree, at a distance of about 10 feet from the base of the tree, during the tree's early dormancy in October or November. All tree roots extending into this trench should be severed. This trench should then be backfilled with good soil, at a mixture of approximately 75 percent soil and 25 percent humus. The purpose of this is to induce the growth of new fine roots closer to the base of the tree, which will enhance the tree's chances for survival after removal and replanting.

2) Immediately before tree removal, a site should be selected and prepared for storage of the trees during lock construction. The total area necessary will be approximately 100 by

30 feet, or 3000 square feet. The area should be prepared for proper drainage, and should contain 1 foot of topsoil and straw mulch to retain moisture. The area should be located away from construction activities, to avoid damage to the trees, and should have a ready water supply (the river water should be suitable).

3) Tree removal should be accomplished using two large end-loaders or backhoes equipped with large buckets with an extended lower blade, in combination with a single large crane equipped with a sling. While the crane is providing lifting power, the two end-loaders should dig to a depth of three to four feet beginning outside the previously dug trench. Moist burlap should be placed immediately on the root/soil mass as it is lifted.

4) To minimize root damage, each tree should be transported the short distance to the storage site by the three pieces of heavy equipment moving in tandem. Each tree should be carefully placed in the moist earth of the storage site, and additional soil placed over the entire root/soil mass.

5) During lock construction, the trees should be watered daily. Observations for significant physiological deterioration of the trees should be made frequently, so that prompt corrective measures may be attempted. An example would be spraying for insects which may attack the weakened trees. Any major scars caused by end-loader or crane operation should be sealed with an accepted tree wound paint.

6) Replanting of the trees should again be accomplished by the same pieces of heavy equipment. Provisions should be made for proper drainage of each planting site prior to planting; sub-grade stones or drain tiles may be necessary. Each tree should be placed on two feet of good organic material and the root/soil mass covered with an additional one to two feet of topsoil. The burlap should not be removed. The earth around each planting site should be firmly, but not excessively, compacted after planting. Heavy pruning of the tree's upper branches is recommended at this point, to reduce the load put on root functioning. Frequent watering during the first growing season is a strict necessity.

7) Provision for guying of the planted trees with steel cables should be made, to last for a period of two years. These cables might be anchored to the rock face or to the lock wall.

Table G-1

LANDSCAPING COSTS

Scientific Name	Quality	Unit Cost	Total Cost
Acer rubrum	4	$ 500.00	$ 2,000
Acer saccharum	4	500.00	2,000
Juniperus chinensis	10	42.00	420
Taxus cuspidata	10	38.40	384
Cotoneaster apiculata	10	10.00	100
Sod	1000 sq yds	4.00	4,000
			$ 8,904
	Profit and Overhead @ 35%		3,026
			$11,930
		USE =	$12,000

Table G-2

ESTIMATED COSTS OF PLANTED MATERIAL

Scientific Name	Height	Caliper	Condition	Unit Price
Trees[1/]				
Acer rubrum	18'	5"	BB	$500.00
Acer saccharum	18'	5"	BB	500.00
Shrubs[2/]				
Juniperus chinensis	4'	-	BB	42.00
Juniperus virginiana	3'	-	BB	48.70
Taxus cuspidata	3'	-	BB	38.40
Cotoneaster apiculata	5'	-	BB	10.00
Sod				
Perfect sod	(sq. yd.)	-	-	4.00

1/ Installation - 65% of material cost.

2/ Installation - 50% of material cost.

Table G-3

ESTIMATED COSTS OF PULLING, STORING
AND REPLANTING FIVE ELM TREES

1.	Cut roots: 3 x 3' trench, 60 ft long = 100 cu yd				
	Labor	=	$ 38.55		
	Equipment	=	100.00		
	Backfill: Labor	=	67.27		
	With profit & overhead	=	$ 280.55	use	$ 300
2.	Remove trees (5); 5 crew-days (40 hours)				
	per hour Labor	=	$ 74.19		
	Equipment	=	60.00		
	2 FEL cat. 992	=	160.00		
	Total, hourly	=	$ 294.19		
	Total, 40 hours	=	$15,886.26	use	$16,000
3.	Maintain trees: 7 man-hours/week; 2 years				
	Labor	=	$ 6,070.00		
	Equipment	=	728.00		
	Materials (mulch)	=	1,800.00		
		=	$ 8,298.00		
	With profit & overhead	=	$11,607.00	use	$11,700
4.	Replant trees, same cost as No. 2, above				$16,000
5.	Maintenance after planting, 6 months				$ 3,000
		TOTAL	=		$47,000

The estimated costs of tree removal, storage and replanting are presented in Table G-3.

The procedure outlined above would be costly, difficult to implement, and prone to failure. Short-term chances of survival for these non-mature trees would be slim; long-term chances of survival would be even poorer, since these trees are vulnerable to the widespread Dutch elm disease. The moving operation would be made more difficult, and the chance of success lessened, by the granular nature of the present substrate. This gravelly soil would tend to fall away from the roots, preventing the formation of a good root ball. Even with great care in handling, the replanted trees would be in a weakened condition, subject to insect or disease attack, wind throw and moisture stress. The replacement of the elms with other species of shade trees seems to be the most logical course of action.

Visual and Physical Enhancement of the Bluff

A detailed study of the unmodified sections of the bluff behind the lock was not part of the Phase A work. The natural bluff, although in a crumbling condition, presents a more pleasing vista from across the river or from the locks than does the concrete retaining wall that extends from the lower end of the locks about 600 feet downstream. The section of the bluff currently remaining unstabilized has considerably less slope than the stabilized area south of it, so might be stabilized by terracing, which would lend itself to landscaping.

Stabilization of the bluff is primarily an engineering problem, and the means of stabilization must be determined before the details of landscaping can be established. Because of the park-like nature of the floodplain and bluffs in this area, and the desire of the public to maintain the scenic values, visual factors should be taken carefully into account in the selection of bluff stabilization measures.

Terrestrial Ecology

Existing Terrestrial Ecosystems

Vegetation. The vegetation cover and human use of the island below Ford Dam were studied in mid-winter by the Corps of

Engineers.[1/] A brief reconnaissance trip was made by the Corps representative on 6 January 1975 for the purpose of identifying floral cover, wildlife use, and human activities. The proposed staging area on the east bank of the river was viewed, but not visited.

The island varies greatly in area, depending on the river level. The maximum area, approximately eight acres, is reached in late summer, when the flow of the river is minimal. The island reaches a minimum area, essentially zero, in late winter of most years, when it is completely covered by water. At such times of high water, the tops of many trees protrude from the water.

At its maximum extent, the island is about 80 percent vegetated (Plate G-2). Three basic plant associations are present: grassland, shrubs and cottonwood-ash woodland. The northern third of the island is grassland, the southern two-thirds wooded, with trees and shrubs up to about 30 feet in height. In places the trees are of sufficient height and density that there is a brushy understory.

The shrub association consists of willow (Salix species), which dominates the northern part of the section and red-osier dogwood (Cornus stolonifera), which predominates in the southern part. Both species are short, the willow reaching about five feet in height, the dogwood about eight feet.

Most of the remainder of the island is covered with an association of cottonwood (Populus deltoides) and ash (Fraxinus species) in densities varying from sparse to nearly continuous. These trees reach about 30 feet in height and 7.4 inches in trunk diameter (one cottonwood). At least one ash noted by Anfang had a trunk diameter of 4.6 inches.

Fauna. The larger animals of the island appear to be limited to birds. The yearly inundation of the entire island probably prevents the establishment of any permanent small mammal populations. Anfang observed ring-necked pheasants (Phasianus colchicus) at the edge of the woodland. Numerous bird nests, left over from the 1974 breeding season, were seen in the branches of shrubs.

1/ Anfang, Robert, "Vegetation Study at L/D No. 1, "Memorandum No. 1, ANFANG/gjj/7233, 9 January 1975, 2 pp & photo.

Waterfowl (ducks) frequent the dam and vicinity throughout the year and may be presumed to nest on the island and on the land to the east of the lock.

Human Use. Use of the island for recreation seems to be slight. Fishermen are reported to fish from the island and to camp there. These and other overnight campers cut some of the trees and shrubs for firewood. No control currently is exercised over recreational use of the island.

More information is needed on recreational use of the island, if this aspect of project impact is to be evaluated reliably. Plans are currently being formulated for observations and counts of visitors to be made (perhaps by the lock attendant) on sample weekends and weekdays during 1975.

Impact of the Project

Project Use of the Island and River Bank. Placement of the cofferdam at the south end of the lock will be facilitated by using the island as a staging area. Sheet pile and equipment will be moved by barge from a landing constructed on the east bank of the river. An area at the south end of the island will be cleared for the unloading and storage of sheet pile and for vehicle movements. A road, wide enough to allow trucks to pass, will have to be cleared from this landing area to the north end of the island. The amount of land required for these operations has not yet been determined.

Consideration was given to alternative locations other than the southern end of the island for unloading construction materials. The channel on the northeast and east side of the island is too shallow to accept barges, and dredging it for this project would impose a substantial impact downstream. The use of the west side of the island would obstruct the shipping channel.

The low area between the island and the lock will be filled with rock, gravel, and sand to an elevation of approximately 688 feet MSL, in order to provide a firm work area for cranes setting the cofferdam. This fill will be removed following project completion, restoring the channel to its original configuration.

No buildings or sanitary facilities will be constructed on the island, but portable, self-contained toilets may be required.

Effects on Terrestrial Ecosystems. The use of the island as a staging area will severely damage the low woodland ecosystems which are gradually developing. Damage could be minimized by the implementation of measures to protect the larger trees from vehicle damage and by careful placement of the landing and storage areas at the south end of the island. Workmen should be restricted from walking in the shrubs on the east side of the island during spring and early summer, in order to minimize disturbance of nesting birds.

Effects on Human Use and Aesthetics. It is doubtful that any fishermen or campers will wish to use the island during the period of construction. Following removal of the construction equipment, recreational use of the island will depend on the extent of efforts made to remove the scars of construction.

A substantial aesthetic impact will result from the use of the island for construction, but this impact is only one facet of the overall impact of the project, the temporary visual impact of construction equipment, noise, and the general increase in human activity on the river and its banks downstream of the dam. The severity of this impact is lessened by the fact that this reach of the Mississippi River has already been heavily civilized, with the dam, locks, buildings, roadways, and waterway traffic. Nevertheless, the wooded island provides a modicum of natural environment to improve the appearance of this area.

Actions to Mitigate Impacts. Two types of actions should be taken to minimize the ecological and aesthetic impacts of the project: precautions during construction and rehabilitation procedures.

A. Construction Activities

1. The area at the south end of the island used for landing and storage of equipment should be kept to a minimum.

2. The routing of the haul road on the island should be planned so as to minimize removal of, or injury to, the larger trees.

3. Consideration should be given to the use of timber mattresses for the road, in order to avoid compacting the soil.

4. The island should not be utilized for borrow or spoil disposal areas, but consideration should be given to the use of rockfill to favorably alter the topography of the island, if this appears desirable and can be accomplished without adverse downstream effects.

5. Fuels and organic solvents should not be stored on the island.

6. Construction crews should be prohibited from cutting or damaging vegetation.

7. Major trees should be identified prior to construction and steps taken to protect them from trunk or root injuries.

8. The area on the east bank destined for construction of the barge landing should be carefully studied prior to planning the placement of the landing and access road.

B. Rehabilitation Procedures

1. All construction debris should be removed from the island at the end of the project and prior to the spring flooding. Failure to do so will result in such material being swept downstream by the spring flows.

2. The haul road and previously wooded storage areas should be mulched and replanted with cottonwood seedlings in order to avoid the visual scar of the haul road. About 200 seedlings would be required for 400 feet of road. If the roadway is not revegetated, some erosion may be expected during periods of high flows. The cost of such revegetation would be slight.

Water Quality and Aquatic Ecosystems

Existing Water Quality

Information on present water quality in the Mississippi River was provided by the Corps of Engineers from data obtained by the Minnesota Pollution Control Agency (MPCA) at Mile 859 and

from the 1973 Quality Control Report of the Metropolitan Sewer Board.[1/]

In general, the Mississippi River contains water of good overall quality. Temperature, pH and dissolved oxygen are continually within the limits established by the MPCA. Coliform bacteria levels are above the limits set for contact recreation (e.g., bathing) but within those for limited-contact use (boating, fishing). Turbidity is generally low, the year's maximum of 50 JTU being reached in August, 1973. Levels of heavy metals in the water are relatively low. Samples at Lock and Dam No. 1 should be analyzed, in order to evaluate the extent to which upstream data are applicable.

Sediments

A preliminary study of the bottom sediments of the Mississippi River is currently in progress,[2/] based on two samples (one with a Peterson Dredge, one with a core sampler) taken just above Lock and Dam No. 1 on 18 November 1974. Efforts to use the dredge on the bottom below the locks proved unsuccessful; apparently the bottom is heavily scoured and virtually without sediments.

Analyses of the samples are expected to be available in April or May, 1975. The analyses will include Unified Soil Classification System, particle study, and analyses for some chemical parameters. The latter will include volatile solids, COD, oil and grease, phosphorus, total solids, metal (Hg, Pb, Zn, As, Cd, Cr, Cu, Ni), and chlorinated hydrocarbons.

Aquatic Ecosystems

No information is available on the state of aquatic ecosystems in the region of Lock & Dam No. 1. The gathering of aquatic ecological data will be required in the next phase of project planning.

1/ Metropolitan Sewer Board, 1974, "Quality Control Report. 1973 Water Quality Data," 101 pp.

2/ Lake, Roger L., 1975, "Sediment Analysis for Bottom Near L/D 1," Memorandum for Record, Corps of Engineers, No. WHITING/11/7233, 2 pp.

Impacts of the Project

The primary causes of impacts to the aquatic environment are expected to be the filling and clearing of the channel between the island and the lock, and the placement and removal of the cofferdam.

The filling of the channel between the island and the lock may be expected to cause some increased turbidity downsteam depending on the type of fill selected and, principally, on the size of the smaller sand particles. Additional siltation may be expected in the event of a flow increase overtopping the filled area.

Care must be taken in the selection of fill material to ensure that water quality standards are not exceeded.

Placement and, especially, removal of the cofferdam will certainly disrupt bottom sediments, possibly introducing undesirable chemicals into the river. The biological effects of chemical reintroduction will be more serious if the work is concentrated into a short time span (as, for instance, when work is being performed on a 24-hour basis, because ecosystems will be denied the flushing action of unaltered water and chemicals will probably build up to higher levels. Similarly, placement and removal of the sheet pile barge landings will release some sediments and fill material downstream. The essential river variable affecting the severity of these impacts will be flow; chemicals will be diluted by higher flows and sediments will be distributed farther downstream. Quantitative predictions of these impacts cannot be made until the analyses of bottom sediments have been completed.

Archeological Investigations

A search of the records of the State Archaeologist and the Federal Register revealed no historic or prehistoric archaeological sites on the island or on the east (left) bank of the river in the vicinity of the proposed staging area. An archaeological survey will be undertaken prior to construction in order to locate any sites which may be present and which should be avoided or salvaged.

Studies for Phase B

Corps of Engineers regulations require that the environmental impact of every project alternative be assessed prior to the selection of the final design. Among the alternatives assessed must be the "no action" alternative. In this case, the "no action" alternative might have severe consequences, due to the possibility of major lock failure. Alternative plans for aspects of the project for which alternatives exist should be examined in terms of environmental impact. The economic and practical feasibility of not using the island at all, or of just using the north end, should be studied carefully. These aspects include the placement of landing areas, placement of the haul road on the island, and the timing of placement and removal of the fill between the island and the lock. Alternative means of obtaining fill material and of disposing of spoil must be examined from the viewpoint of cost, practicality, and environmental impact. Detailed baseline information must be gathered for the preparation of the Environmental Assessment. This information must be gathered during the warm months and must include data on wildlife, fisheries and aquatic ecosystems, and human use of the island, the river, and the affected areas of the shore. These studies should include the following.

Terrestrial Ecosystems

Biological Assessment. The island and shoreline areas should be visited once in early May and again in mid-June 1975, for the purpose of evaluating the faunal use of the island. The biologist performing the visit should be a competent field naturalist, able to identify birds, which are believed to constitute the dominant macrofauna. Each visit should be planned to include at least two consecutive mornings and the intervening day. A third visit should be made in September to evaluate the use of the island by fall migrants.

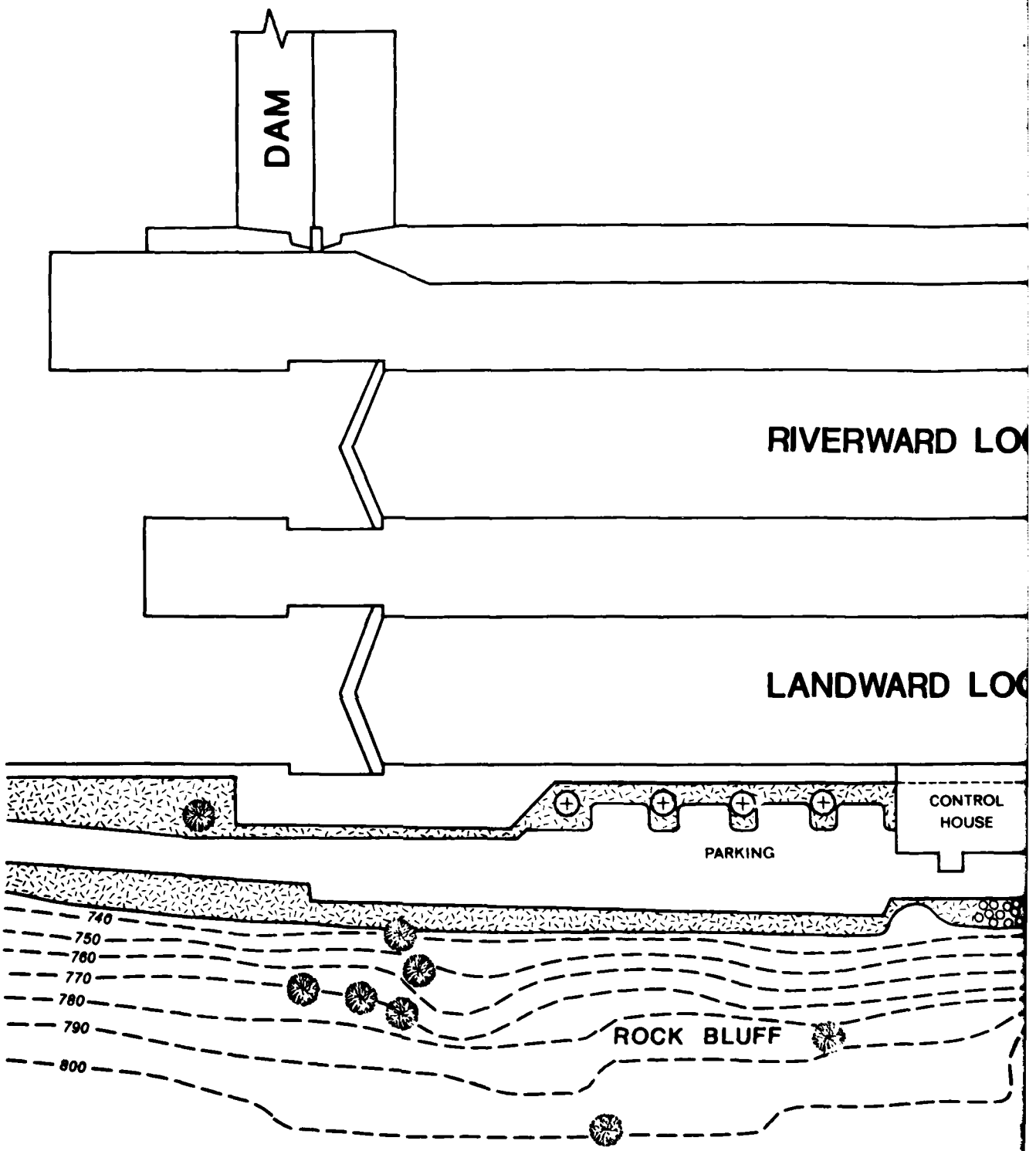
Human Use. Periodic counts should be made during the spring, summer, and fall to evaluate recreational use of the island. Data could be gathered by observation from the lock, or better, from the elevated bluffs along shore. A telescope or binoculars will be required. The observer should count visitors, by activity, on at least two weekends and two weekdays per month, at times of day that will include various recreational activities.

Water Quality and Aquatic Ecosystems

Sediment Study. In addition to the sediment samples currently being analyzed, samples should be secured from the shore areas where the barge landings are to be placed.

Aquatic Ecosystems should be evaluated for the reach of the river below the lock and the island, and along the shore in areas to be disturbed. Particular attention should be paid to the presence of spawning areas of fish. Information on the spawning of fish in the neighborhood of the dam should be sought from the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, and the University of Minnesota. If information is not forthcoming, an estimate of fish spawning activity could be derived by analogy with other river reaches of similar bottom characteristics, water velocities and water quality.

An estimate of the relative richness of the aquatic ecosystem in the part of the river below the dam should be attempted in order to more accurately predict project impact. This estimate should be based on 10-12 benthic samples taken above, immediately below, and farther below the dam. These samples should be examined for the identity and diversity of the organisms represented.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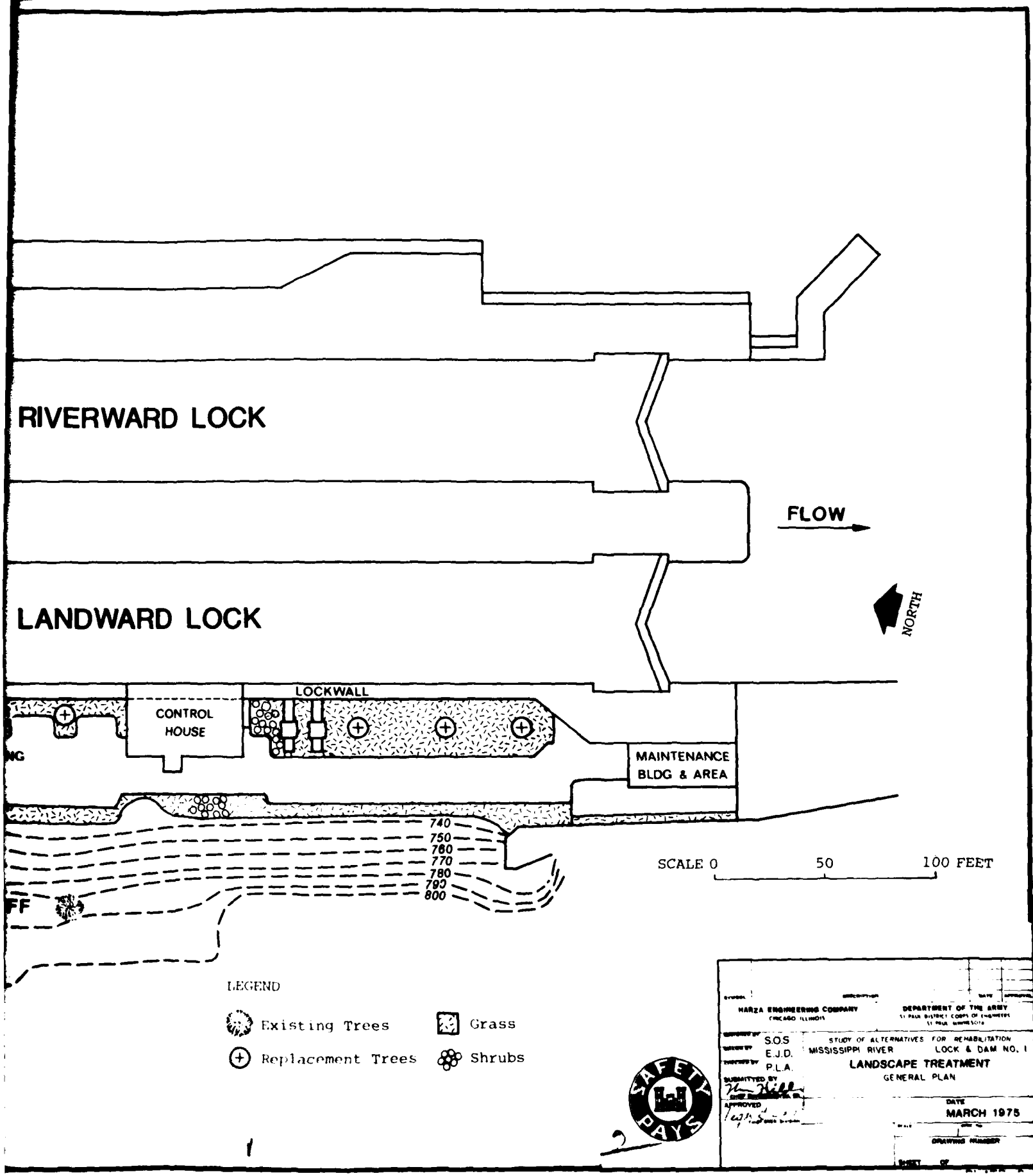
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SCALE 0 50 100 FEET
LEGEND
Existing Trees
Grass
Replacement Trees
Shrubs
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DEPARTMENT OF THE ARMY
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STUDY OF ALTERNATIVES FOR REHABILITATION
MISSISSIPPI RIVER LOCK & DAM NO. 1
LANDSCAPE TREATMENT
GENERAL PLAN
SUBMITTED BY
APPROVED
DATE
MARCH 1975
DRAWING NUMBER
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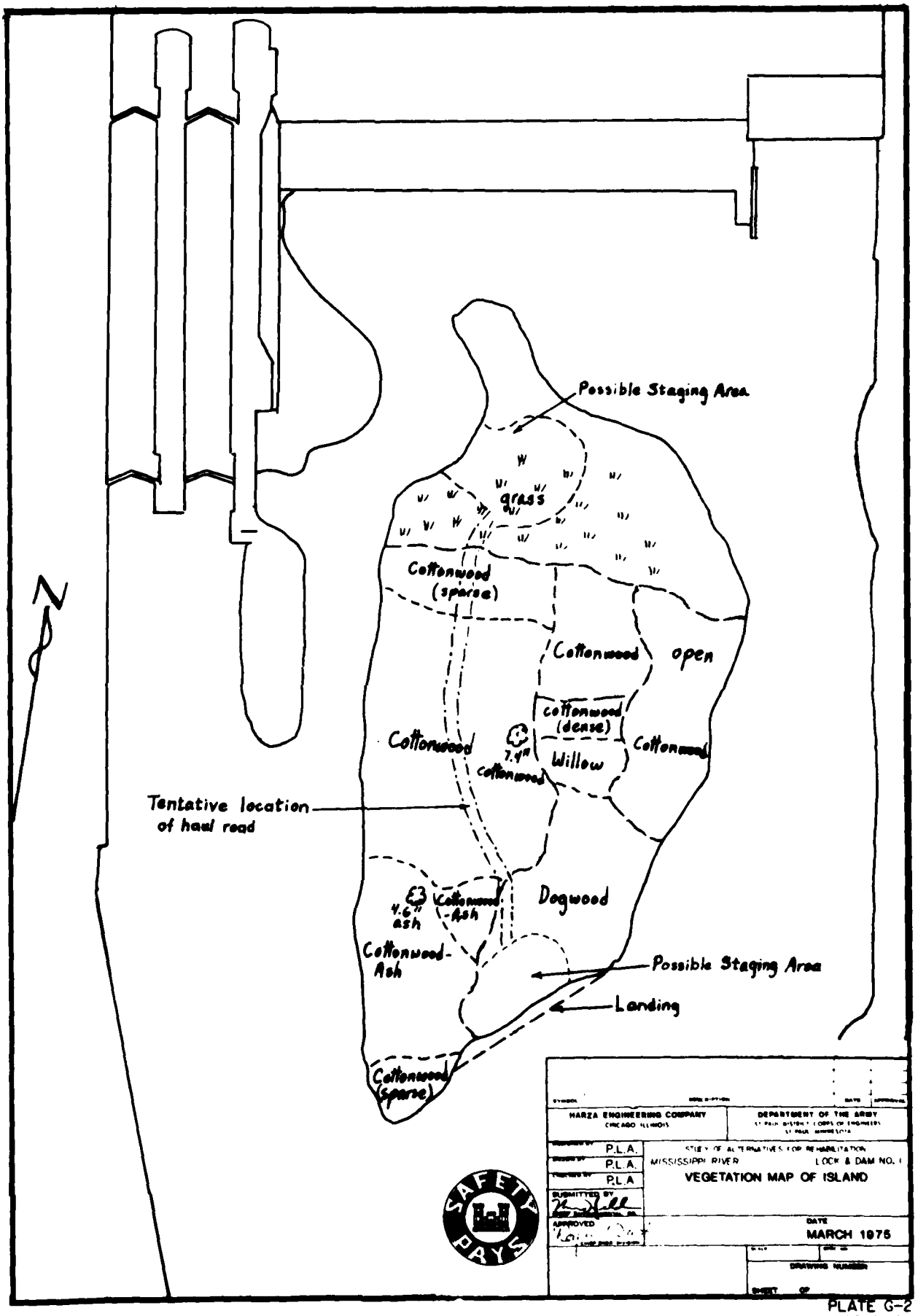
SAFETY PAYS



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DESIGNED BY P.L.A.	STUDY OF ALTERNATIVES FOR REHABILITATION
DRAWN BY P.L.A.	MISSISSIPPI RIVER LOCK & DAM NO. 1
CHECKED BY P.L.A.	VEGETATION MAP OF ISLAND
SUBMITTED BY	DATE MARCH 1975
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PLATE G-2

DEPARTMENT OF THE ARMY

ST. PAUL DISTRICT, CORPS OF ENGINEERS

1210 U. S. Post Office & Custom House

St. Paul, Minnesota 55101

MISSISSIPPI RIVER

STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1

MINNEAPOLIS, MINNESOTA

APPENDIX H

MECHANICAL INVESTIGATIONS

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SKETCHES

Appendix H

MECHANICAL INVESTIGATIONS

I. MITER GATES

A. Repairs

1. Description

Years of continued use have caused deterioration of the miter gates of both locks. At present, the diagonals of all the gates are loose and the gates themselves appear limber and distorted. Structural damage coupled with the warped gates cause considerable leakage past the gates. The gates also appear to be somewhat corroded and it can be assumed that significant pintle wear has occurred.

The Corps of Engineers specifies a 50-year service requirement for the miter gates of rehabilitated locks. The overall condition of the existing miter gates was established by visual inspection of the gates from the top of the lock and guide walls, through discussions with the lockmaster and from diver's inspection reports. Certain repairs to these gates will be required in order to meet this 50-year service criteria.

In order to more accurately determine the condition of the gate leaf structures, further detailed inspection is required. It is our recommendation that closer visual inspection along with ultrasonic plate thickness measuring techniques be used to more accurately assess the extent of corrosion and structural deterioration in the gate structure. During the design memorandum phase of this project, the exposed portions of the gate leaves should be inspected for deterioration in this manner. Based on these results, further ultrasonic inspection of the continuously submerged portions of the gates may be required during the construction period after the locks have been unwatered.

The required gate reparations include providing cathodic protection, replacing pintle bushings, eye bar bushings, and anchor and gudgeon pins. The embedded gate anchorages on the lower miter gates will be reinforced in a manner similar to that presently in existence on the upper miter gates.

The overall scheme of the repair of the miter gates will be taken from the Corps of Engineers report "History: Pintle Repair, Diagonal Installation and Diagonal Prestressing Lower Miter Gates; Lock and Dam No. 1, 1950-1951." This report covers the repairs to the lower miter gates of both locks in the winter of 1950. It is believed all of these repairs are again warranted and that the techniques for jacking, bracing, cribbing, blocking and adjustment of gate leaves and procedures for replacement of pintles and bushings can generally be utilized for the repairs required at the present time.

In addition to the work done in the winter of 1950, sandblasting and painting of the leaves and replacing all timber fenders appear to be required. The installation of some means of ice protection for the gate leaves was suggested by the lockmaster and also appears justified. Our recommendations for the ice protection installation are detailed in Section I.C. of this design appendix (page H-5).

The Corps of Engineers' 1951 report offered several suggestions which would aid in the future rehabilitation of miter gate leaves. One such suggestion was the modification of the present means of adjusting the gate diagonals. The present method of lowering a man over the side of the gate to adjust the turnbuckles located in the center of the gate was found to be extremely risky as well as time consuming. Our recommendations for modifying this arrangement are covered in detail in Section I.B. of this appendix (page H-4).

2. Procedure for Repair of Miter Gates

The following operations will be performed on the upper and lower miter gates of the landward lock during the general construction period after the locks and construction area have been dewatered:

a. Erect scaffolding.

b. Remove timber fenders.

c. Sandblast gate leaves (excluding leaf bottoms).

d. Install jacking brackets similar to those used in the previous gate reparation operations.

e. Each leaf, excluding bottom, will be visually inspected (and ultrasonically tested if examination during the design memo phase suggests it's warranted) for corrosion and structural damage and any necessary repairs and rivet replacement will be made. The miter bearing blocks will be realigned as necessary, and miter gate guides will be installed.

f. The brackets for locking the gate leaves in the open position and any modifications necessary for connection to the new miter gate operators will also be made at this time.

g. Remove scaffolding and brace gate leaves in the partially open position in the manner used previously.

h. Lift each gate leaf 2'-0" using four 75-ton hydraulic jacks.

i. As each leaf begins to rise, remove the 5-inch upper anchorage pin and the 4-inch pin with its anchorage eye bar.

j. Add extension pieces to the diagonal struts and mounting brackets for prestressing jacks as shown on Plates H-2 and H-3.

k. Replace all bronze pintle bushings with "Lubrite" bushings and pintle balls.

l. Replace the bronze bushings in the upper eye bar with "Lubrite" bushings.

m. Inspect, straighten and repair the bottom of each gate leaf.

n. Sandblast and paint the underside of each gate leaf.

o. Lower each gate leaf to its normal elevation and reinstall upper anchorage bars.

p. Prestress and adjust each gate leaf using hydraulic stressing jacks. The basic procedure to be followed will be patterned after Contract No. DA-21-018-ENG-292 used in the winter of 1950 with the final tension being recorded using hydraulic pressure gauges. The recording of these pressures will enable retension-ing to these readings without unwatering the lock.

q. Adjust top anchorage bars to obtain the best contact between the leaves at the miter and quoin blocks when the gates are in the fully closed position.

r. Reerect scaffolding and paint the gates.

s. Install ice protection plating on the upstream face of the leaves as described in Section 1.C. and shown in Plate H-4.

t. Install new timber fenders and remove scaffolding.

B. Prestressing Provisions

The provisions for prestressing miter gate diagonals at Lock and Dam No. 1 currently consist of turnbuckles located roughly near the mid-point of the diagonals. The specific method for achieving the correct tension in the diagonals is covered in C of E Specifications 51-9-HL dated January 31, 1951 and the subsequent report of those operations in 1951. While this method for determining the correct tension in the diagonals is adequate, it is believed that the means of tensioning those diagonals can be improved. The following point was noted on page 10 of the "History of Pintle Repair, Diagonal Installation and Diagonal Prestressing 1950-1951":

> "The turnbuckles on the diagonals on these gates are located near the center at the very inconvenient point and can be reached only by scaffolding. In this case they were worked on from swinging scaffolds, and due to the nature of the operations involved, the work was very hazardous. The design of diagonals of this type and size might be improved upon if the turnbuckles could be dispensed with and provisions made at the top of the gate for providing the pulling stresses through jacking pressure and the tension held by shims or a

large nut, thus permitting improved workability and rapid completion of any changes in length and stress of diagonals."

It is our recommendation that this modification be done utilizing standard commercial hydraulic post-tensioning jacks as normally used in prestressed concrete construction (Stressteel Corporation, Union City, California, or other). Using a standard hydraulic tensioning jack would allow the use of rented equipment for the relatively infrequent gate prestressing operations. We propose extending the diagonals with a fabricated piece ending in a 1-3/8" dia. threaded steel rod. This corresponds to the largest diameter normally available stressteel bar. The loads in the diagonals would be carried by a holding nut bearing on a fabricated support bracket attached to each corner of the top of the gate leaf (see Plates H-2 and H-3).

When prestressing is required, a hydraulic tensioning jack mounted on the support brackets and connected to a hydraulic pump and pressure gauge would provide an accurate measure of the stress in each diagonal without the use of strain gauges. Should future restressing of the diagonals be required, it could be accomplished using the initial readings without unwatering and with a minimum amount of effort. While such a prestressing would not be as effective as the original prestressing, its simplicity would afford an inexpensive means of periodic adjustment not available with the present system.

The additional materials needed for this prestressing method are 16 sets of jacking brackets ($350 ea.) and diagonal extensions ($280 ea.) per lock. It is our estimation that the resulting additional expense of $10,100 per lock (hydraulic jack rental included in equipment rental) is justified by the simplification and reduced risk of future adjustments over the 50 year life of the gates.

C. Ice Protection Plating

1. Description

At the suggestion of the Lockmaster at Lock and Dam No. 1, a study was undertaken for a means to eliminate the problem of small ice floes becoming lodged in the upstream beams of the

lower miter gates during the early winter periods of the lock operation season. This collection of ice causes unfavorable loading conditions on the gate which increase loads on the leaves' anchorages and hasten the leaf's warpage. Our recommendation for the solution to this problem is the fastening of lightweight aluminum skinplates over the spacing between the beams on the upstream side of the leaves which would prevent the gate from collecting ice during winter operation. To provide this protection, coverage would be provided for the upstream surface of the downstream miter gates between G-3 and G-15, inclusive. These plates would be installed in a manner similar to that shown on the enclosed sketch (Plate H-4).

To provide structural support for these thin plates, the space between the gate skinplate, beams and aluminum skinplate would be filled with a closed-cell polyurethane foam.

This arrangement was selected to minimize the addition of weight to the gates, while still providing the necessary coverage for varying water levels in the locks and providing reasonable resistance to impact from floating ice or debris. A detailed design study will be required during the design memorandum phase of the project to further refine this concept in order to evaluate the thickness of the aluminum skinplate required to withstand the impact from large pieces of floating debris, and to evaluate and minimize the buoyant effects of the foam on the prestressing of the gate leaves.

The additional cost of such an ice protection system consisting of aluminum skinplating and foam filler for 2 lower leaves is estimated at $16,700 per lock.

D. Sketches

Plate H-1 - General Plan, Equipment Location

Plate H-2 - Arrangement for Tensioning Diagonals

Plate H-3 - Arrangement for Tensioning Diagonals

Plate H-4 - Ice Protection Plating

II. MITER GATE OPERATORS

A. Description

The existing miter gate operators at Lock and Dam No. 1 consist of hydraulically moved racks rotating gear segments linked by rods to the miter gate leaves. The condition of this equipment is poor and replacement is required in order to provide the specified 50-year life.

The suggestion was made by the C of E, and subsequent study has shown it feasible to replace the existing equipment with a hydraulic cylinder directly connected to the gate, powered by a variable and positive displacement piston pump. This arrangement will be closely patterned after the existing installations at the St. Anthony Falls Locks.

A complete system of motor, pump and hydraulic cylinder will be provided for each gate leaf. A hydraulically-operated safety latch device to automatically lock the miter gate in the recessed position will also be provided for each gate leaf similar to St. Anthony Falls. The general arrangement of this installation is shown on Plate H-5.

The installation of the new operating equipment requires very little concrete removal due to the large blockouts for the existing equipment. All the equipment for the downstream operators will be located in the same blockout as shown in Plate H-5. The electric motor and hydraulic pump units for the upstream miter gate operators will be located approximately 25 feet downstream of the gates (see Plate H-1). They will be located just below the top of the lock in a recess where the present filling valves are located. Since these valves will be moved downstream, this area will be available without removing concrete for a new blockout. This location is required, in order to protect the hydraulic pump units from flood waters similar to those occurring in March 1965, which overtopped the upper miter gates. The unused portions of the blockouts remaining from the old equipment will be filled with concrete.

B. Sketch

Plate H-5 - Miter Gates, Operating Machinery

III. FILLING AND EMPTYING VALVES

A. Comparison of Alternatives for Lock Valves

1. Introduction

In studying the requirements for rehabilitating the lock filling and emptying systems at Lock and Dam No. 1, the feasibility of using one of several different types of valves was evaluated. The Corps of Engineers suggested study of butterfly valves and tainter gates. Additionally we felt that the use of wheel gates, sluice gates and slide gates for this application also warranted evaluation studies.

2. Butterfly Valves

The application of butterfly valves to the present lock arrangement is complicated by the lack of available space for the operating mechanism. After discussing possible arrangements with potential manufacturers, it was concluded that serious technical problems and extremely high equipment costs made such an installation an unfeasible solution.

Since no standard commercially produced butterfly valve could be applied to this installation without major modifications, it is believed that few manufacturers could be interested in manufacturing such equipment. This alternative was then dicarded.

3. Tainter Gate Valves

The tainter gate valve is the most commoly used arrangement for locks of this size in the United States. The physical space limitations at Lock and Dam No. 1 prohibit the use of this arrangement for the emptying valves. Tainter gates are then applicable only to the lock filling system.

Tainter gates have several advantages for application to lock filling systems. Principal among these advantages is the vast experience available from successful installations and the

availability of extensive model study data. But while tainter gates have advantages to recommend their use in new locks where the structures can easily incorporate the valve installation, it was found that applying a tainter gate to an existing lock requires more space than the other alternatives studied.

In installing a tainter gate filling valve in Lock and Dam No. 1, large amounts of concrete need to be removed from the present lock walls. The cost of this removal and accompanying reinforced concrete liner increases the comparative cost of such an installation to nearly twice the cost of the most economical alternative (see Section A-7, pages H-12 and H-13 of this chapter).

In addition to those costs utilized in the comparison, other considerations suggest the rejection of the tainter gate alternative. The large blockout required for a tainter gate would greatly reduce the stability of the monolith in which it is located. This would be a particularly severe problem in plan 4 where two valves would be placed side by side in the center lock wall. This would require additional provisions to stabilize this monolith. These costs have not been included in the cost comparison.

The use of tainter gate filling valves would also increase design, manufacturing and maintenance costs. Since a different type of valve would be required for the emptying system, two complete different designs would be required at considerable cost. This would result in higher manufacturing costs from the smaller order quantities and complicate maintenance by limiting part interchangeability.

4. Wheel Gates

Wheel gates are commonly used for water regulation in powerhouse intakes and are the subject of extensive design experience although little of this experience comes from lock installations. This type of gate has a simple sealing system, has a low friction factor requiring a small hoist and is easy to remove for maintenance.

The low friction in this type of gate can cause vibration problems but current design practices using direct acting

selfdamping hydraulic hoists can usually eliminate this problem. Another disadvantage to a wheel gate is the large number of potential maintenance items. Each wheel bearing in the gate is a potential source of failure and maintenance and is particularly prone to damage from sand and grit.

The cost of a wheel gate installation is fairly moderate although still roughly 20% higher than the most economical alternative (see Section A-7, pages H-12 and H-13).

5. Commercial Sluice Gates

Commercially available sluice gates made to manufacturers standard designs (Rodney Hunt, Armco, etc.) are frequently used for water regulation in irrigation projects at considerably higher operating loads than present at Lock and Dam No. 1. This type of gate would rely on well-proven designs and standard components requiring a minimum of engineering expense. These gates utilize a very simple design requiring a minimum of maintenance, and allowing for simple removal. While such a design has high friction forces requiring a large hoist, this friction provides excellent vibration damping.

One major disadvantage of commercial sluice gates is the limited experience the manufacturers have with the relatively high frequency of operation in an environment with extensive sand and grit, as required for lock valves. While the manufacturers contacted believe that the proper selection of sealing and slide materials will yield the required life, this remains an unproven factor and damage from sand and grit would be very difficult and costly to repair. These gates are also relatively heavy and thus require larger operators.

The most significant disadvantage of commercial sluice gates is the cost of such an installation (Section A-7, pages H-13 and H-14). The high cost of these gates brings the comparative cost of filling valves to 138% of the most economical alternate. For the emptying valves, however, the related construction costs raise this to over 210%. This arises from the necessity of removing the wall castings embedded in the lock walls for the

installation of the thimbles utilized in the commercial sluice gate design.

6. Slide Gates

Slide gate valves, i.e. fabricated slide gates utilizing a Teflon sled or pad sliding on a stainless steel track plate can be effectively used where operating heads are low enough to keep the bearing pressure on the Teflon pad within reasonable limits and where friction forces do not require excessive hoisting forces. These conditions exist at Lock and Dam No. 1 making slide gates a feasible alternative.

As with wheel gates, slide gates are easily adaptable to use in the existing structures, thus minimizing the related construction costs. The higher friction forces in slide gates give better vibration damping than wheel gates while at the same time eliminating the potential maintenance of wheel bearings. The slide gate design offers the simplest possible arrangement for such an installation.

One disadvantage to a slide gate is the increased hoisting force required to overcome the friction forces. In the application of a slide gate to Lock and Dam No. 1, neither the friction forces nor the required hoist size are found to be unreasonable.

Another disadvantage to the use of a slide gate is the lack of experience with such gates applied to lock filling systems. However, if the bottom surface of the gate is properly shaped in accordance with latest practice, ventilation is provided to the conduit roof immediately downstream of the gate, and an adequately dimensioned, full width, vertical access shaft is provided just upstream of the gate guides, it is expected that no problems would arise from such an installation. In the absence of experience, this would have to be confirmed by model tests which would reproduce all of the possible filling conditions to which the gates would be subjected.

The possibility of damage to the gates from abrasion by sand and grit on the moving surfaces will exist regardless of the type of gate used. While tainter gates are the least prone to

such damage, space and cost considerations appear more critical in the selection of the gate type. In a slide gate, the selection of a woven, porous teflon slide material will allow such foreign material to embed itself into the teflon and thus protect the CRES track plate. By selecting the proper slide material and designing both the slide and track plate for easy removal, this problem can be minimized. Slide gates should suffer considerably less damage and require less maintenance from this problem than the commercial sluice gate alternative. Fixed wheel gates are expected to suffer less damage from abrasion than slide gates in respect to the amount of material eroded from the wheel rims and tracks, but are much more sensitive to dimensional changes than slide gates. In addition there is no available way to prevent the entrance of sand or grit particles to the wheel bearings, which are extremely prone to damage under such conditions.

From the comparative costs, a slide gate valve installation at Lock and Dam No. 1 is estimated to be the most economical alternative of those studied.

7. Cost Summary of Valve Alternatives

The following cost estimates are comprised of costs for the gates and related hoist equipment, and an estimate of comparative construction costs. The construction costs listed are differential costs intended for comparing alternatives; therefore construction cost items common to all alternatives are omitted.

a. Filling Valves

(1) Two Slide Gates:

Gate Equipment	91,000
Construction Cost	53,000
Total	143,000

7. Cost Summary of Valve Alternatives (continued)

(2) Two Wheel Gates:

Gate Equipment	108,400
Construction Cost	65,600
Total	174,000

(3) Two Commercial Sluice Gates:

Gate Equipment	148,000
Construction Cost	47,000
Total	195,000

(4) Two Tainter Gates:

Gate Equipment	96,500
Construction Cost	168,000
Total	264,500

b. Emptying Valves

(1) Two Slide Gates:

Gate Equipment	103,000
Construction Cost	14,000
Total	117,000

(2) Two Wheel Gates:

Gate Equipment	120,000
Construction Cost	14,000
Total	134,000

b. Emptying Valves (continued)

(3) Two Commercial Sluice Gates:

Gate Equipment	148,000
Construction Cost	84,500
Total	232,000

8. Recommendations

Based on the relative estimated costs and related service factors, it is our recommendation that slide gates be considered for the filling and emptying valve systems at Lock and Dam No. 1. This alternative offers the lowest cost and simplest modification to the existing structure. To insure no undesirable hydraulic effects in the filling conduits, it is our recommendation that the filling conduit system be subjected to a model test prior to the completion of the contract bid documents. The hydraulic model tests can be used to confirm the hydraulic adequacy of the gate and the dimensioning of the vents and the necessary vertical access shaft.

B. Slide Gates for Filling and Empyting Systems

1. Description

The filling and empyting systems at Lock and Dam No. 1 are presently operated by Stoney Gate Valves. Long years of service have worn these valves into a poor overall condition.

This type of valve is rather complex and inefficient and has resulted in extensive maintenance requirements. Their replacement with new Stoney Gate Valves is not considered economical or desirable.

Based on the comparison study covered in Section A of this Chapter, we recommend replacing these valves with slide gate valves. These will be fabricated steel gates with Teflon slides mounted to the gate sliding on stainless steel track plates. This arrangement is depicted in Plate H-6. To improve their

hydraulic performance, the filling valves will be relocated at El. 681.2 vs El. 708.7 of the present valves. The emptying valves will be located in their present position.

Each gate will be operated by a hydraulic cylinder directly connected to the gate. Each clyinder will be powered by a variable and positive displacement piston type hydraulic pump unit. In order to provide for emergency operation at twice the normal operating speed, a second identical motor-pump unit will be provided. For emergency operation both units will operate simultaneously, while normally only one will operate with the other available as a spare. A complete system of motors, pumps and hydraulic cylinder will be provided for each gate and will be located in a niche adjacent to each valve slot.

The emptying valve slot arrangment will be designed to, utilize the Stoney Gate slot, utilizing the existing wall castings for guides. This will yield substantial savings in construction costs.

2. Sketches

Plate H-6 - Slide Gates, General Arrangement

IV. VALVE BULKHEADS

A. Description

The rehabilitation of Lock and Dam No. 1 includes the redesign of the intake and discharge manifolds. This redesign places the intake upstream and the discharge downstream of the lock unwatering bulkheads. In order to unwater the lock chamber and to unwater an operating valve, valve bulkheads are required to close the filling and emptying conduits.

Each new conduit bulkhead will be made of four 2'-6-1/2" high sections bolted together. The arrangement of these bulkheads is shown in Plates H-7 and H-8. New embedded parts will be required for all slots. Bulkhead slots will be provided upstream and downstream of each filling and emptying valve. The slots located downstream of the filling valves will be relocated to accommodate the relocated valves, while all other slots will be retained in their present location.

B. Sketches

Plate H-7 - Valve Bulkhead Assembly

Plate H-8 - Valve Bulkhead Details

Plate H-9 - Valve Bulkhead Embedded Parts

V. LOCK BULKHEADS

A. Description

The current means of unwatering Lock and Dam No. 1 is through the use of two poiree needle dams across the face of the lock. This arrangement is rather difficult to install and remove, and provides limited protection against high water elevations. It was suggested by the Corps of Engineers that roller bulkheads of the type used at the St. Anthony Falls Locks be designed to exceed the ten year flood water elevations of 731.1 upstream and 707.7 downstream.

Due to the infrequent need for lock unwatering and very low probability that both Lock and Dam No. 1 and one of the St. Anthony Falls Locks would need to be unwatered at the same time, it is our recommendation that the 13 - three foot high lock bulkhead sections from the St. Anthony Falls Locks be transferred to Lock and Dam No. 1 and used for unwatering should the need arise. To provide the specified protection of the lock during a 10-year flood, an additional height of 4.4 feet upstream and 10.5 feet downstream are needed for the bulkheads.

To provide this, seven new 2.2' high lock bulkhead sections (2 upstream and 5 downstream) will be used beneath the sections from St. Anthony Falls in closing the lock.

The new 2.2 foot high lock bulkhead sections will be designed to withstand the required head and to fit the same slot arrangement as the existing sections. The arrangement of these new sections will be identical to that of the old sections now in use at St. Anthony Falls, with lower height and increased plate and web thicknesses. It is estimated that these new sections will weigh approximately the same or less than the existing section thereby not increasing the lifting requirements for installing the sections.

To accommodate these bulkhead sections, the existing upstream and downstream lock bulkhead slots at Lock and Dam No. 1 must be modified and continued to the sill of the lock. Plates H-10 through H-14 show the designed lock bulkheads in position and the modified upstream and downstream bulkhead slots. The bulkhead slots will be similar to those used in the St. Anthony Falls Upper Lock.

B. Sketches

Plate H-10 - Upstream Lock Unwatering Bulkhead Sections

Plate H-11 - Downstream Lock Unwatering Bulkhead Sections

Plate H-12 - Lock Bulkhead Slot: New and Existing

Plate H-13 - Upstream Lock Bulkhead Slots

Plate H-14 - Downstream Lock Bulkhead Slots

VI. MOORING PROVISIONS AND MISCELLANEOUS MECHANICAL ITEMS

A. Description

The rehabilitation of the concrete lock walls and decks necessitates the replacement of check posts and snubbing buttons. In addition, a traveling mooring bitt along the top of the upstream and downstream guide wall, two tow haulage units located one each on the upstream and downstream guide walls, and three floating mooring bitts, recessed in the land wall, will be provided.

All mooring provisions will be similar to those used in the St. Anthony Falls Project.

Tow haulage units will be hydraulically operated with infinite variable speed, have a minimum capability of 10,000 lb line pull, and have a drum capacity of 400 feet of 1/2" cable.

A revolving pillar jib crane with a one ton electric chain hoist will be deck-mounted on top of the landwall immediately upstream of each miter gate for removing debris and loading it into a dumpster from which it will be hauled away by truck.

New boat davits will be provided on the upper and lower guide walls. Overhead protection from falling rocks will be provided for the boat davit platform on the lower guide wall.

To allow for the removal and replacement of the filling and emptying valves and hoist cylinders and the valve bulkheads, a rubber-wheeled portable adjustable gantry crane with a four ton hand operated chain hoist will be provided. This gantry will be especially important for servicing the downstream I-wall valves and bulkheads under plan 4. Under this plan these valves will be directly under the control house and the valves and hoists will require handling with very limited headroom. The gantry will also be useful in handling the downstream valve bulkheads which will be underneath the lock bridge for all four plans.

B. Sketches

Plate H-15 - Tow Haulage Layout

Plate H-16 - Traveling Mooring Bitt Layout

VII. DE-ICING SYSTEM

A. Description

The compressed air de-icing system in present use at Lock and Dam No. 1 is outdated and fails to supply enough air to the critical locations to adequately protect the mechanical parts during cold weather periods.

A new system will be provided to both prevent ice buildups from hindering lock operations during the late months of the shipping season and to prevent damage to the vulnerable mechanical equipment during winter shutdown periods. This new air system will also provide compressed air for the operation of air tools for maintenance and repair work when the de-icing system is not in use.

Air to this system will be supplied by a 100 cfm, 100 psi air compressor located in the control house. For the rehabilitation of both locks (plan 4), two compressors of this size will be required.

The air discharge nozzles for each lock will be arranged in the following manner:

1. Four in each miter leaf wall recess.

2. Four in front of the upstream face of each miter leaf.

3. Three on each quoin area.

4. Two in each filling and emptying valve slot.

VIII. STATION SERVICES

A. Description

The rehabilitation of Lock and Dam No. 1 includes the construction of a new control house. Provisions will be made to air condition portions of the control house and to provide plumbing, heating, and ventilation. Water lines will be pitched for self draining in order to protect them against freeze-up. Provisions will also be made to furnish adequate fire protection for both the control house and lock area.

The sewage system from the new control house will be connected to the city sewer line. This system will include a force main from the lock area to the city sewer at Nawadaha Boulevard and 47th Avenue South, together with a grinder pump and two lift stations.

The fire protection system will require a sump to be constructed upstream of the lock which will enable river water to be utilized for fire protection even when the lock is unwatered. The water will be distributed throughout the lock area by two 200 gpm pumps located, one on the landwall of the lock and one on the intermediate wall of the locks, with firehoses spaced along the top of the lockwalls. For the rehabilitation of both locks (plan 4), a third pump and firehouse system will be installed on the river wall.

IX. TEMPORARY REPAIR OF THE RIVER LOCK MACHINERY

A. Description

Plan 2 for the rehabilitation of Lock and Dam No. 1 requires use of the river lock as a temporary means of passing shipping during the time of the rehabilitation of the land lock. Before the river lock is used extensively, its miter gate operators and Stoney Gate valves should be repaired, since age, disuse and part switching with the land lock have caused extensive deterioration.

Miter gate operator repairs require the removal and rebuilding of the hydraulic cylinder, replacement of worn components, such as bushings and rollers, and reparation of leading hydraulic pressure lines and valves where necessary. Whenever possible, parts from the four operators taken from the land lock shall be utilized.

The Stoney Gate valves of both locks will also be removed. The four in the best operating condition will then be chosen and repaired. Replacement of any extensively worn parts will be undertaken using the parts of the remaining four valves whenever possible.

X. SUMMARY OF MECHANICAL COSTS

1. Miter Gate Repairs

Item No.	Item	Quantity	Unit Price	Basis*	Amount
1-A	General labor for rehabilitation (includes labor for items below except where specifically noted)	1 set		A	$136,000
1-B	Temporary materials used in rehabilitation	1 set		A	54,000
1-C	Equipment rental	1 set		A	15,000
1-D	New Lubrite pintle bushings (Mat'l)	1 set of 4	$2,100/ea.	D	8,400
1-E	New Lubrite anchorage bar bushings (Mat'l)	1 set of 8	$100/ea.	D	800
1-F	New diagonal extensions (Mat'l)	1 set of 16	$280/ea.	E	4,500
1-G	New diagonal extension jacking brackets (Mat'l)	1 set of 16	$350/ea.	E	5,600
1-H	New gate guard timbers (Mat'l)	1 set of 70	$150/ea.	F	10,500
1-I	Labor and materials for sandblasting and painting including scaffolding rental	1 set		C	125,000

* Basis for estimate shown under paragraph 13.

1. Miter Gate Repairs (Continued)

Item No.	Item	Quantity	Unit Price	Basis*	Amount
1-J	Labor and materials for reinforcing embedded gate anchorages (lower gate)	1 set		E	4,500
1-K	Labor and materials for miter gate guides	2 ea.	$3,000/ea.	B	6,000
1-L	Allowance for labor and materials for straightening gate bottom and replacing gate rivets			B	20,000
1-M	Miter gate bolt-back system (lower gates)	1 set		I	750
1-N	Ice protection plating	1 set		F	16,700
	TOTAL				407,750
	Say				408,000

2. Miter Gate Operator

Item No.	Item	Quantity	Unit Price	Basis*	Amount
2-A	Cylinder assembly (Mat'l)	1 set of 4	$4,000/ea.	E	16,000
2-B	Pump unit at'l)	1 set of 4	$5,000/ea.	G	20,000
		1 set of 4	$1,000/ea.	G	4,000

2. Miter Gate Operator (Continued)

Item No.	Item	Quantity	Unit Price	Basis*	Amount
2-D	Latch (Mat'l)	1 set of 4	$350/ea.	D	1,400
2-E	Existing operator removal (Labor)	1 set of 4	$4,600/ea.	B	18,400
2-F	New operator installation and testing (Labor)	1 set of 4	$6,400/ea.	B	25,600
	TOTAL				85,400
	Say				86,000

3. Slide Gate Filling Valves

Item No.	Item	Quantity	Unit Price	Basis*	Amount
3-A	Gates	2 ea.	$14,000/ea.	E	$28,000
3-B	Hoist cylinders	2 ea.	$4,500/ea.	E	9,000
3-C	Hydraulic pump unit	4 each	$5,000/ea.	G	20,000
3-D	Limit switch assy.	2 each	$1,000/ea.	G	2,000
3-E	Motor and miscellaneous equipment	4 each	$2,000/ea.	G	8,000
3-F	Embedded parts	2 each	$12,000/ea.	E	24,000
	TOTAL Gate Equipment for 2 Gates				91,000

4. Slide Gate Emptying Valves

Item No.	Item	Quantity	Unit Price	Basis*	Amount
4-A	Gates	2 each	$14,000/ea.	E	$28,000
4-B	Hoist cylinders	2 each	$4,500/ea.	E	9,000
4-C	Hydraulic pump units	4 each	$5,000/ea.	G	20,000
4-D	Limit switch assy.	2 each	$1,000/ea.	G	2,000
4-E	Motor and miscellaneous equipment	4 each	$2,000/ea.	E	8,000
4-F	Embedded parts (2 slots-9000 lb/ea.)	2 each	$18,000/ea.	E	36,000
	TOTAL Gate Equipment for 2 Gates				103,000

5. Filling and Emptying Valve Bulkheads

Item No.	Item	Quantity	Unit Price	Basis*	Amount
5	1 set of bulkhead assemblies	4 ea.	$4,500/ea.	E	$18,000

6. Valve Bulkhead Embedded Parts

Item No.	Item	Quantity	Unit Price	Basis*	Amount
6-A	Filling valve:				
	1. Upstream slot (parts and installation)	2 ea.	$3,200/ea.	E	6,400
	2. Downstream slot (parts and installation)	2 ea.	$6,000/ea.	E	12,000

6. Valve Bulkhead Embedded Parts (Continued)

Item No.	Item	Quantity	Unit Price	Basis*	Amount
6-B	Emptying valve:				
	1. Upstream slot (parts and installation)	2 ea.	$6,000/ea.	E	12,000
	2. Downstream slot (parts and installation)	2 ea.	$6,000/ea.	E	12,000
	Total for 1 set embedded parts				42,400

7. Lock Bulkhead

Item No.	Item	Quantity	Unit Price	Basis*	Amount
7-A	New bulkhead sections	7 each	$24,000/ea.	D	168,000
7-B	New pickup beam	1 each	$8,000/ea.	D	8,000
7-C	New truck	2 each	$1,150/ea.	D	2,300
	TOTAL				178,300
	Say				178,500

8. Bulkhead Slot Embedded Parts

Item No.	Item	Quantity	Unit Price	Basis*	Amount
8	1 set of embedded parts (2 upstream and downstream slots)			H	40,000

9. Mooring Provisions and Miscellaneous Items

Item No.	Item	Quantity	Unit Price	Basis*	Amount
Plans 1, 2, and 3:					
9-A	Floating mooring bitts	3 each	$27,400/ea.	A	82,200
9-B	Traveling mooring bitts	2 each	$20,500/ea.	D	41,000
9-C	Check posts	31 each	$375/ea.	D	11,600
9-D	Tow haulage unit	2 each	$29,000/ea.	G	58,000
9-E	Revolving pillar jib cranes	2 each	$3,000/ea.	I	6,000
9-F	Boat davits			I	5,000
9-G	Portable gantry crane	1 each	$3,900/ea.	G	3,900
	Total Cost for 1 set				207,700
	Say				208,000

Item No.	Item	Quantity	Unit Price	Basis*	Amount
Plan 4:					
9-A	Floating mooring bitts	6 each	$27,400/ea.	A	164,400
9-B	Traveling mooring bitts	2 each	$20,500/ea.	D	41,000
9-C	Check posts	49 each	$375/ea.	D	18,400
9-D	Tow haulage unit	2 each	$29,000/ea.	G	58,000

9. Mooring Provisions and Miscellaneous Items (Continued)

Item No.	Item	Quantity	Unit Price	Basis*	Amount
9-E	Revolving pillar jib cranes	2 each	$3,000/ea.	I	6,000
9-F	Boat davits			I	5,000
9-G	Portable gantry crane	1 each	$3,900/ea.	G	3,900
	Total cost 1 set + 1 partial set				296,700
	Say				297,000

10. De-icing System

Item No.	Item	Quantity	Unit Price	Basis*	Amount
	Plans 1, 2, and 3:				
10-A	Valves and piping			B	28,000
10-B	Air compressor			G	16,000
	Total				44,000
	Plan 4:				
10-A	Valves and piping			B	42,000
10-B	Air compressor			G	32,000
	Total				74,000

11. Station Service

Item No.	Item	Quantity	Unit Price	Basis*	Amount
Plans 1, 2, and 3:					
11-A	Fire protection			G	65,000
11-B	Sanitary facilities			E-I	44,000
11-C	Heating, ventilatiing and air conditioning			B	25,000
	Total				134,000
Plan 4:					
11-A	Fire protection			G	100,000
11-B	Sanitary facilities			E-I	44,000
11-C	Heating, ventilating and air conditioning			B	25,000
	Total				169,000

12. Repairs to River Lock Machinery

Item No.	Item	Quantity	Unit Price	Basis*	Amount
12-A	Remove and replace Stoney Gates	4 each	$7,000/ea.	B	28,000
12-B	Allowance for Stoney Gate replacement parts	4 sets	$10,000/ea.	B	40,000
12-C	Remove and replace miter gate operator	4 each	$3,400/ea.	B	13,600

12. Repairs to River Lock Machinery

Item No.	Item	Quantity	Unit Price	Basis*	Amount
12-D	Allowance for miter gate operator replacement parts	4 each	$3,000/ea.	B	12,000
	Total				93,600
	Say				94,000

13 Key for Cost Estimate Basis

A Actual costs from the C. of E. updated using ENR indices.

B Estimates based upon judgement.

C Calculated areas and current construction costs.

D Weights shown on C. of E. drawings and estimated cost per pound.

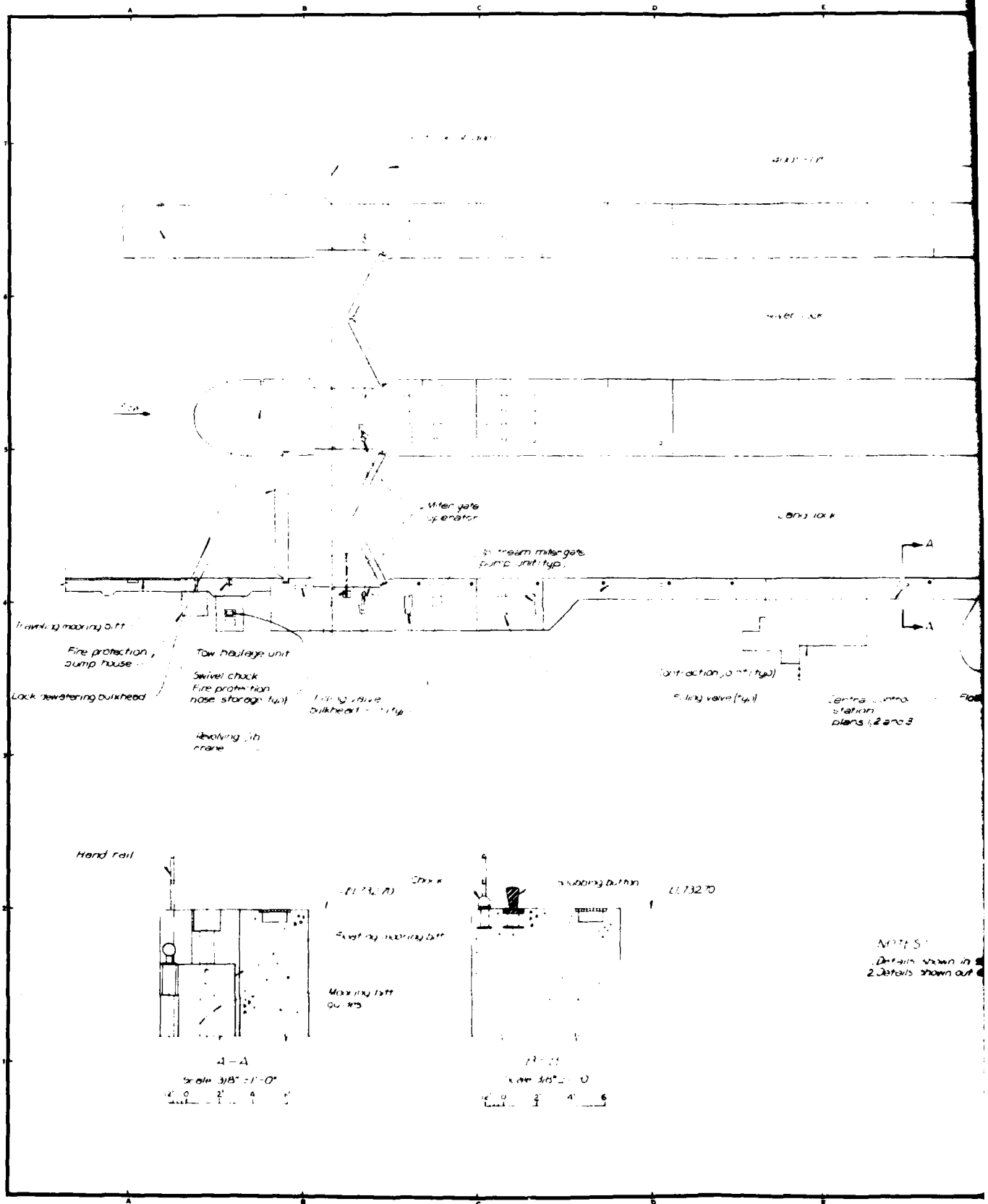
E Estimated weights and estimated cost per pound.

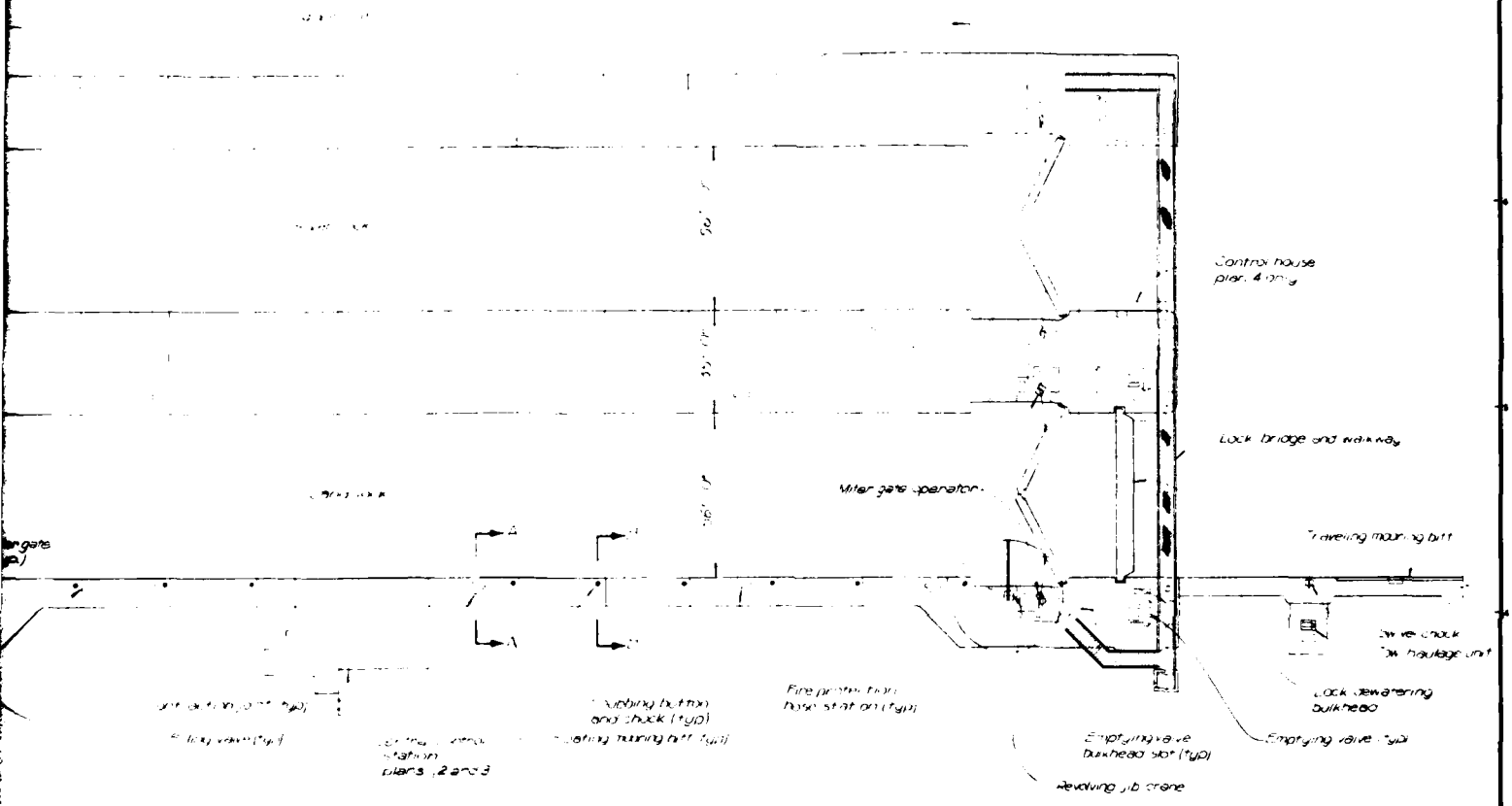
F Estimated quantities and current material unit costs.

G Manufacturers cost estimates adjusted for installation and extra features.

H Weights calculated according to details shown on C. of E. drawings and estimated cost per pound.

I Cost estimates made by C. of E.


Fire protection pump house
Tow haulage unit
Swivel chock
Fire protection hose storage (typ.)
Lock dewatering bulkhead
Revolving jib crane
Hand rail
Mooring bitt
A – A
Scale 3/8" = 1'-0"
B – B
Scale 3/8" = 1'-0"



NOTES:
1. Details shown in solid lines apply to all plans
2. Details shown out of function apply to plan 4 only

SCALE 1" = 20'
0 20
Except as noted

HARZA ENGINEERING COMPANY CHICAGO ILLINOIS		DEPARTMENT OF THE ARMY ST PAUL DISTRICT CORPS OF ENGINEERS ST PAUL MINNESOTA
DESIGNED BY I.T.L.	STUDY OF ALTERNATIVES FOR REHABILITATION	
DRAWN BY S.T.	MISSISSIPPI RIVER	LOCK & DAM NO. 1
CHECKED BY R.L.P.	MECHANICAL INVESTIGATIONS	
SUBMITTED BY	GENERAL PLAN	
APPROVED BY	EQUIPMENT LOCATION	
	DATE MARCH 1975	
	SCALE 1"=20'	DRAWING NUMBER
	SHEET OF	

PLATE H-1

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Arrangement for Tensioning Diagonals COMPUTED_____ CHECKED_____	PROJECT Lock and Dam No. 1 FILE NO 800A DATE 1/75 PAGE ____ OF ____ PAGES

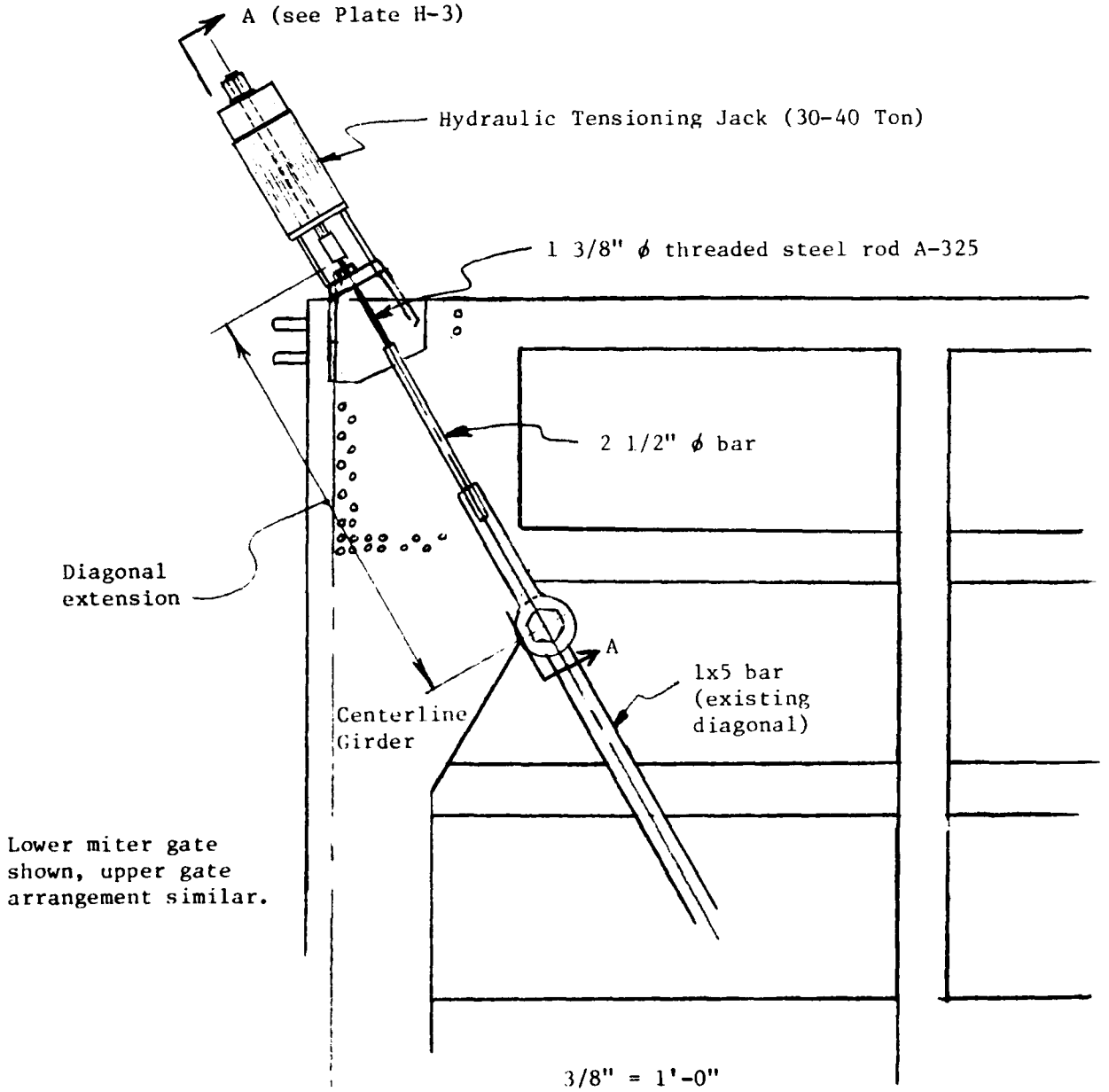
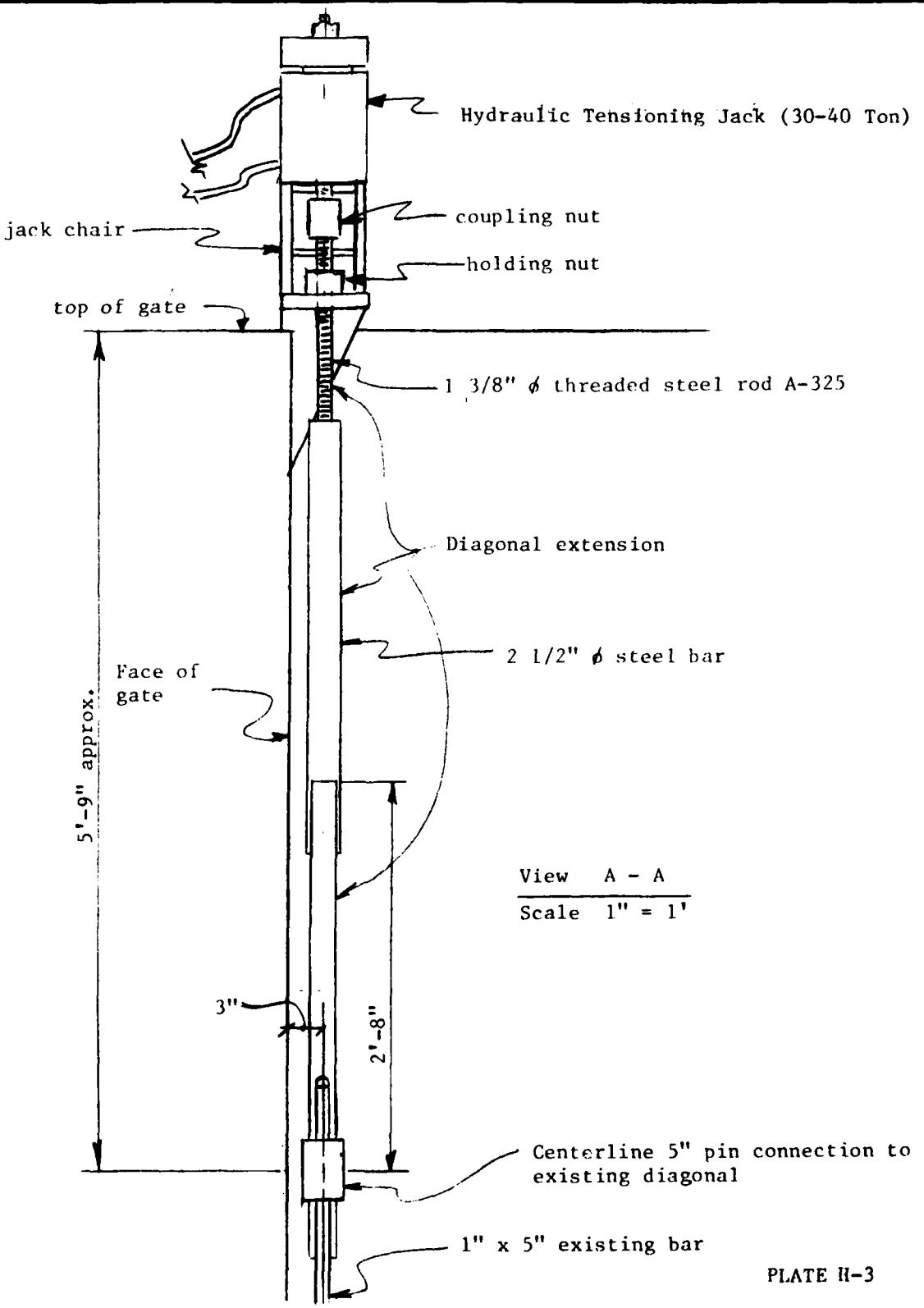


PLATE H-2

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Arrangement for Tensioning Diagonals	PROJECT Lock and Dam No. 1
	COMPUTED ____ CHECKED ____	FILE NO 800A
		DATE 1/75 PAGE ____ OF ____ PAGES

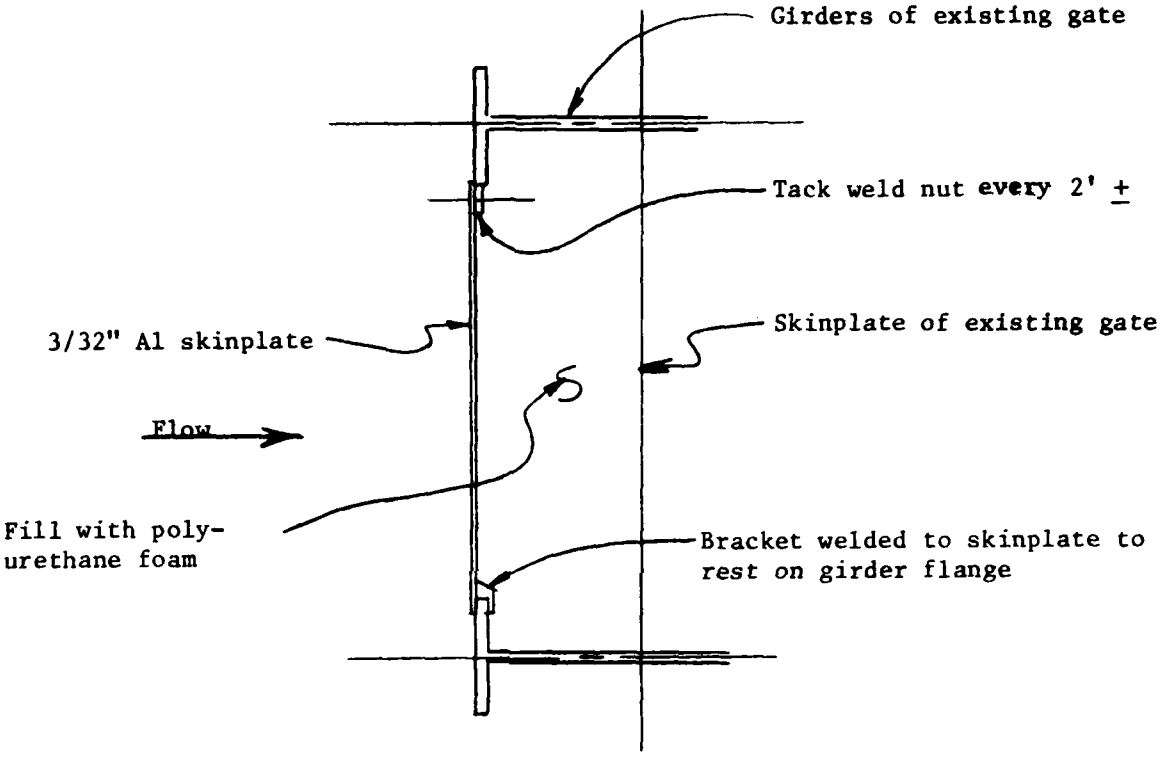


View A - A

Scale 1" = 1'

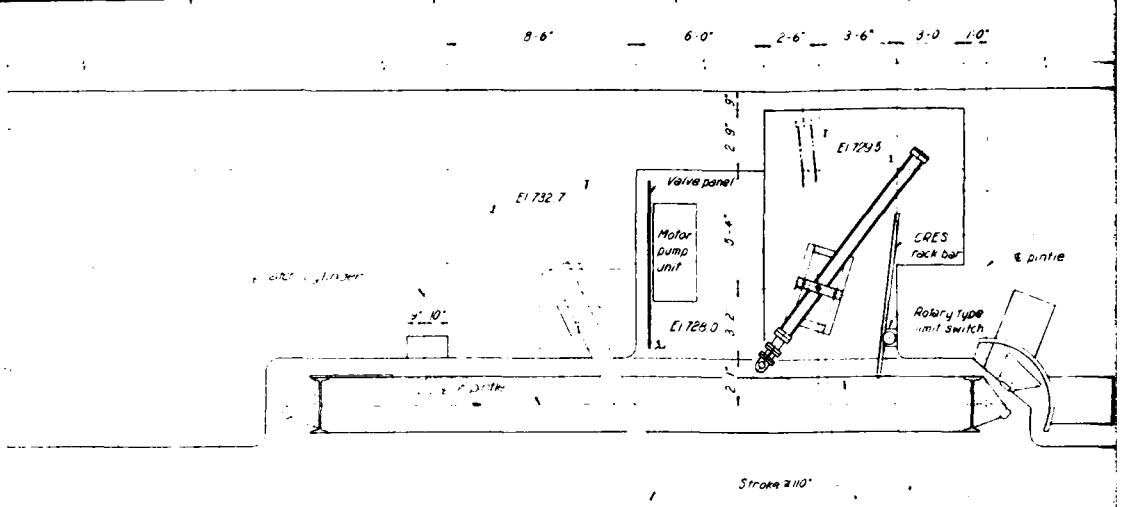
PLATE H-3

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Ice Protection Plating	PROJECT Lock and Dam No. 1
		FILE NO 800A
	COMPUTED ____ CHECKED ____	DATE 1/75 PAGE ____ OF ____ PAGES



Section through Upper Gate Leaf

PLATE H-4

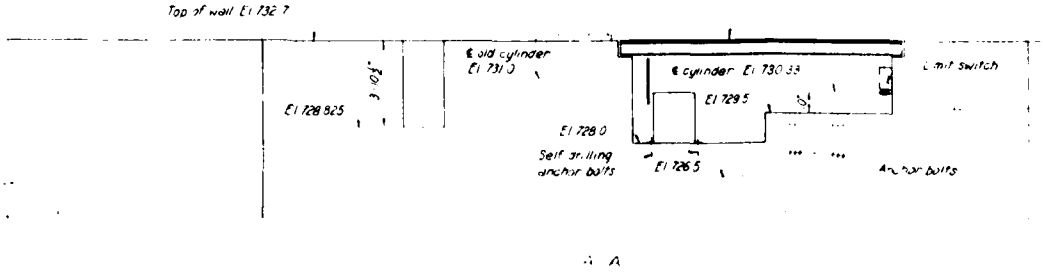


Flow

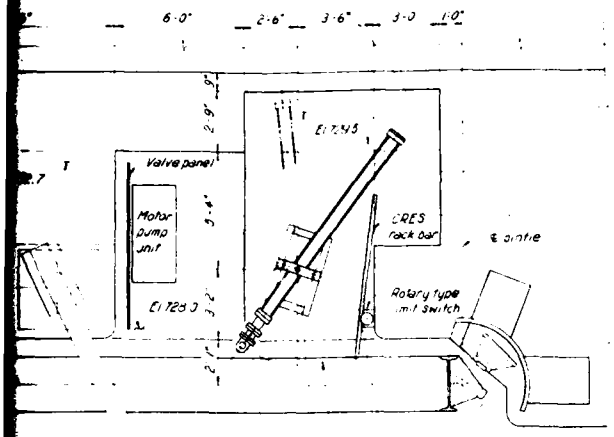
A

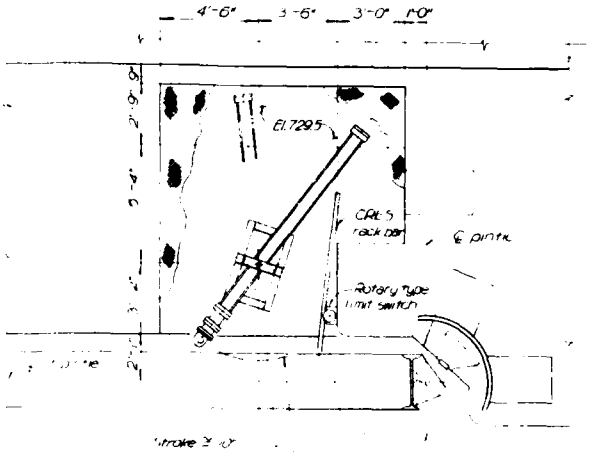
℄ lock

PLAN AT DOWNSTREAM MITER GATE



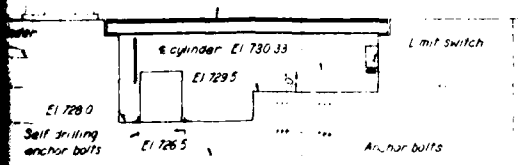
A A





PLAN AT UPSTREAM MITER GATE

STREAM MITER GATE



A A

SCALE 1" = 1'-0"

HARZA ENGINEERING COMPANY
CHICAGO ILLINOIS

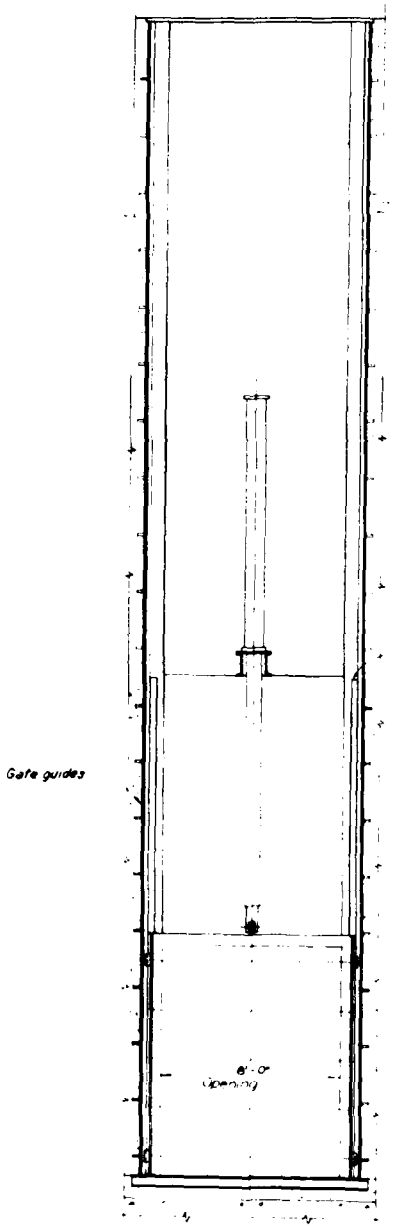
DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
ST PAUL MINNESOTA

STUDY OF ALTERNATIVES FOR REHABILITATION
MISSISSIPPI RIVER LOCK & DAM NO. 1
MECHANICAL INVESTIGATIONS
MITER GATES
OPERATING MACHINERY
DATE
MARCH 1975

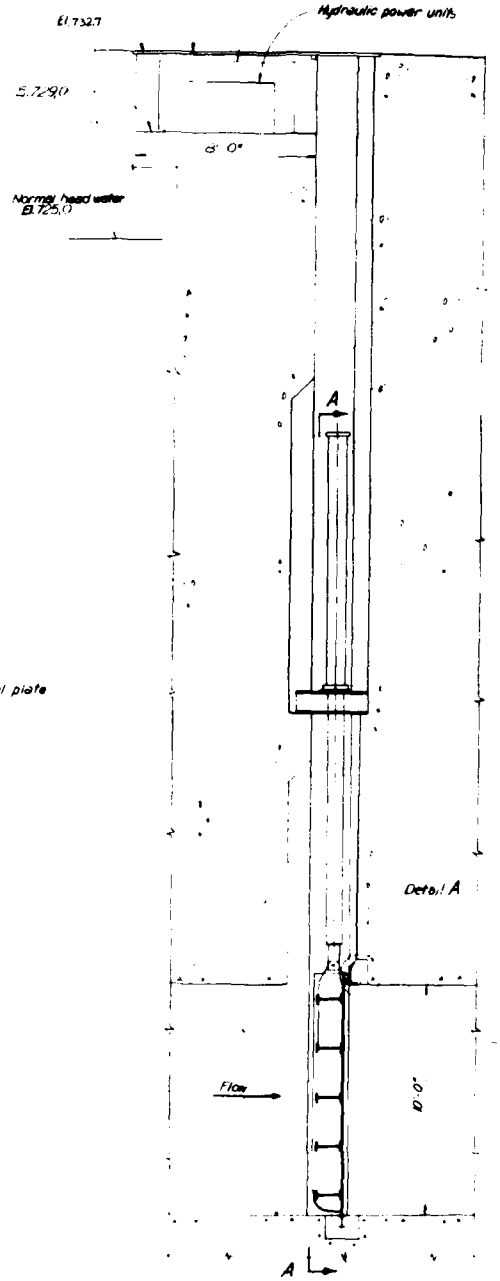
DRAWING NUMBER

SHEET OF

PLATE H-5

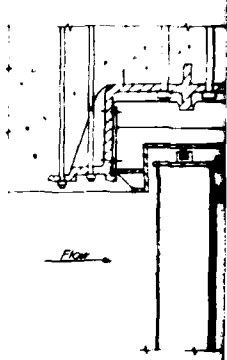


A - A
Scale $\frac{3}{8}$" = 1'-0"



SECTION THRU ℄ FILLING CULVERT
Scale $\frac{3}{8}$" = 1'-0"

(Emptying culvert similar except for gate slot and deta



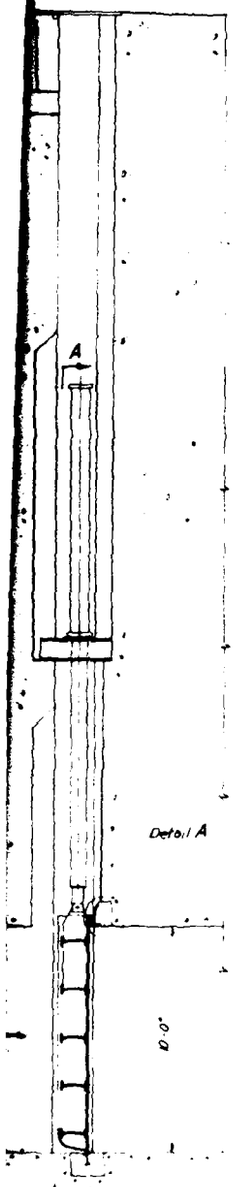
DETAIL
BLOCKOUT EMPTY
UTILIZING EXISTI
Scale $\frac{3}{4}$" = 1

PLAN
Scale

1

Control and wiring panel

Hydraulic power units



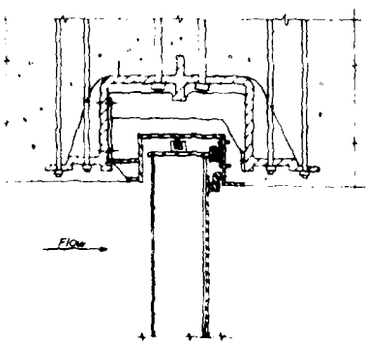
A

ION THRU ℄ FILLING CULVERT

Scale ⅜"=1'-0"

Part similar as at for gate [illegible]

Existing wall casting



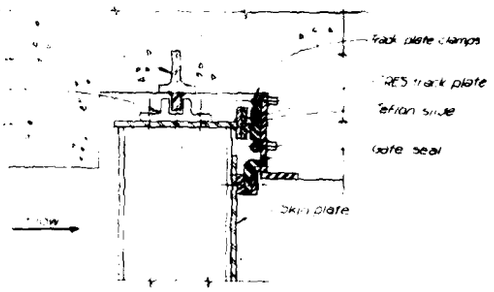
DETAIL B

BLOCKOUT EMPTYING VALVES
UTILIZING EXISTING WALL CASTINGS

Scale ⅜"=1'-0"

Embedded [illegible] slide

[illegible] slide



DETAIL C

BLOCKOUT FILLING VALVES

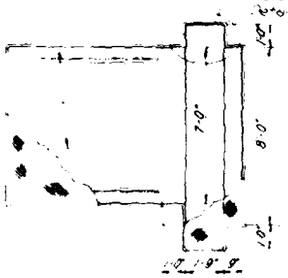
Scale ⅜"=1'-0"

6" 0 1'

[illegible] power units

Detail B emptying valves

Detail C filling valves



PLAN EL 7327

Scale ⅜"=1'-0"

Normal tail water [illegible]

SCALE ⅜"=1'-0"

0 2 4 6

Except as noted

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

DESIGNED BY [illegible]

DRAWN BY [illegible]

TRACED BY [illegible]

SUBMITTED BY [illegible]

APPROVED [illegible]

[illegible] ALTERNATIVES FOR REHABILITATION

MISSISSIPPI RIVER LOCK & DAM NO. 1

MECHANICAL INVESTIGATIONS

SLIDE GATES

GENERAL ARRANGEMENT

DATE

MARCH 1975

DRAWING NUMBER

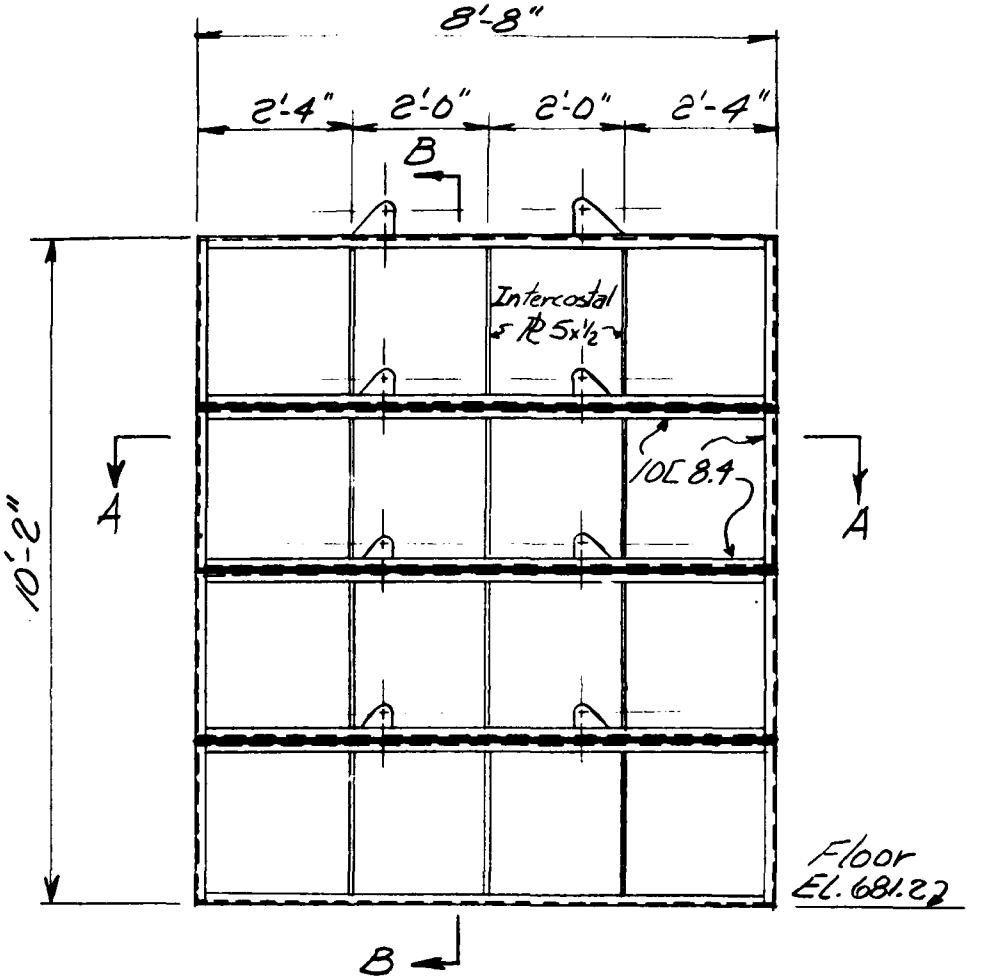
SHEET OF

SAFETY DAYS

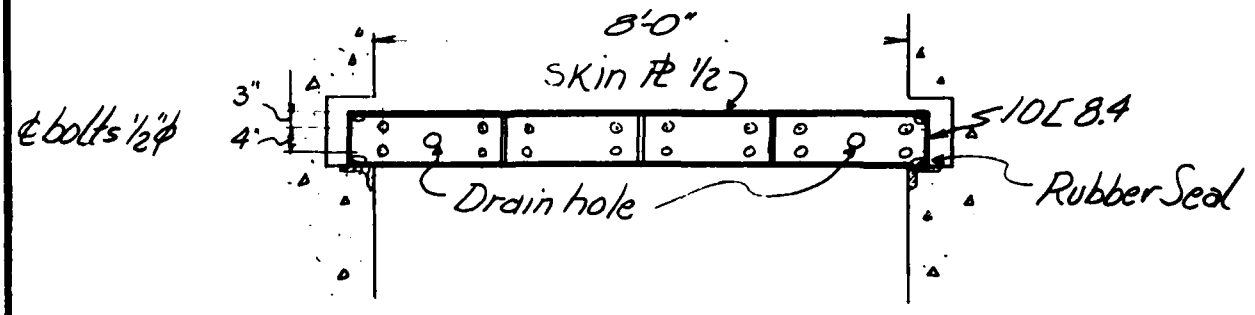
PLATE H-6

1 2

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Valve Bulkhead Assembly	PROJECT Lock and Dam No. 1
		FILE No. 800A
	COMPUTED ____ CHECKED ____	DATE 1/75 PAGE ____ OF ____ PAGES



ELEVATION



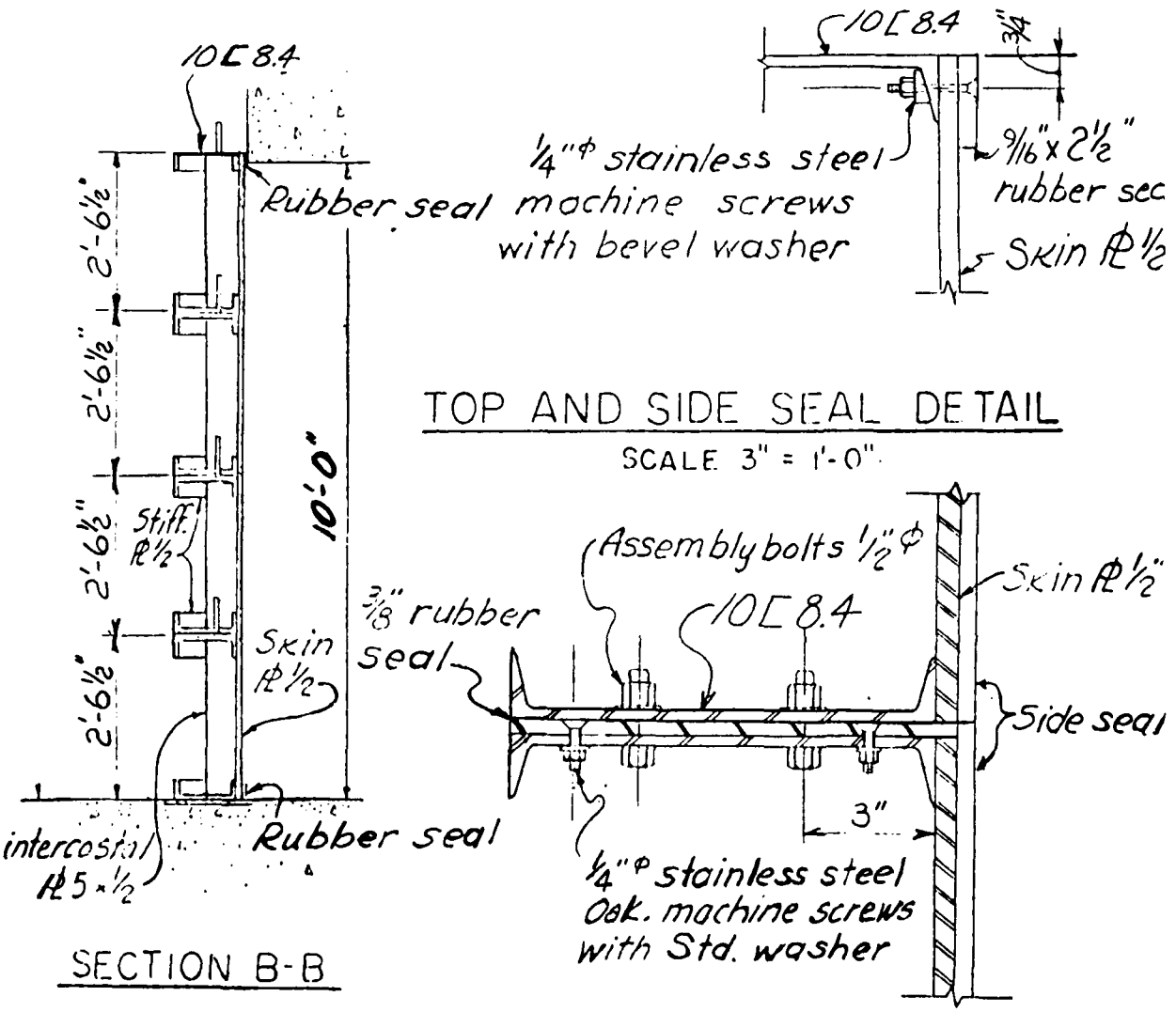
SECTION A-A

Scale ⅜" = 1'-0

PLATE H-7

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Valve Bulkhead Details	PROJECT Lock and Dam No. 1
		FILE NO 800A
	COMPUTED ____ CHECKED ____	DATE 1/75 PAGE ____ OF ____ PAGES



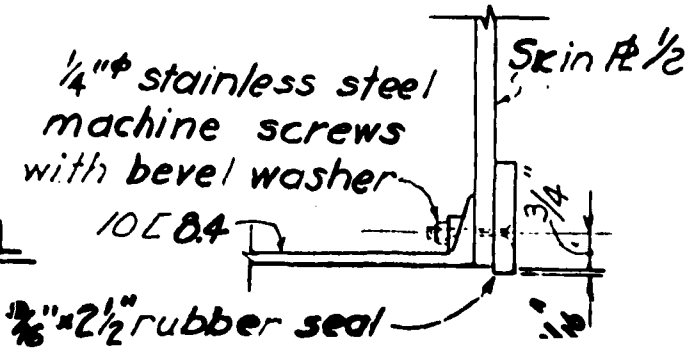
TOP AND SIDE SEAL DETAIL

SCALE 3" = 1'-0"

SECTION B-B

SEAL BETWEEN BULKHEAD SECTIONS

SCALE 3" = 1'-0"

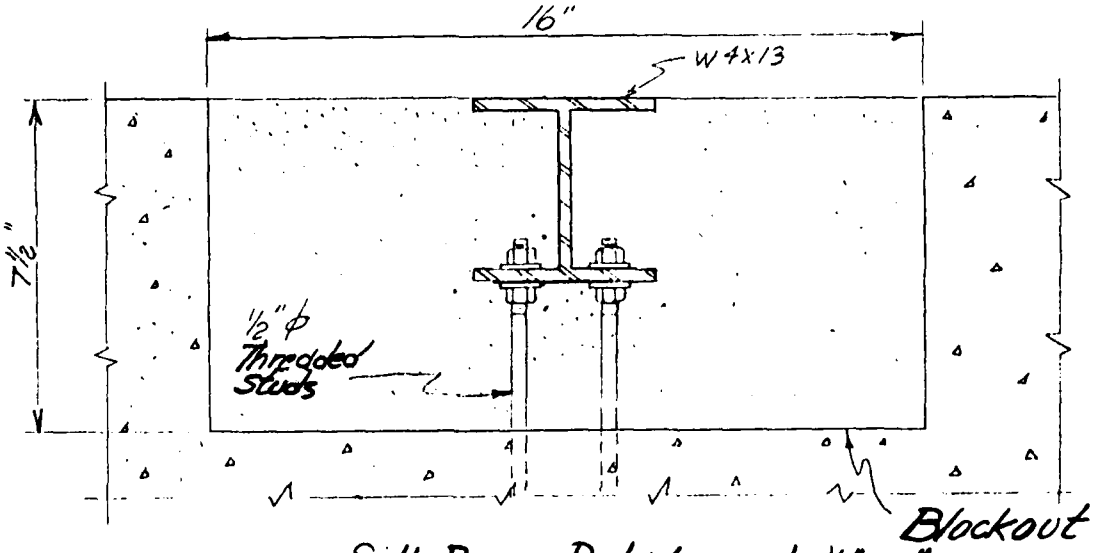


BOTTOM SEAL DETAIL

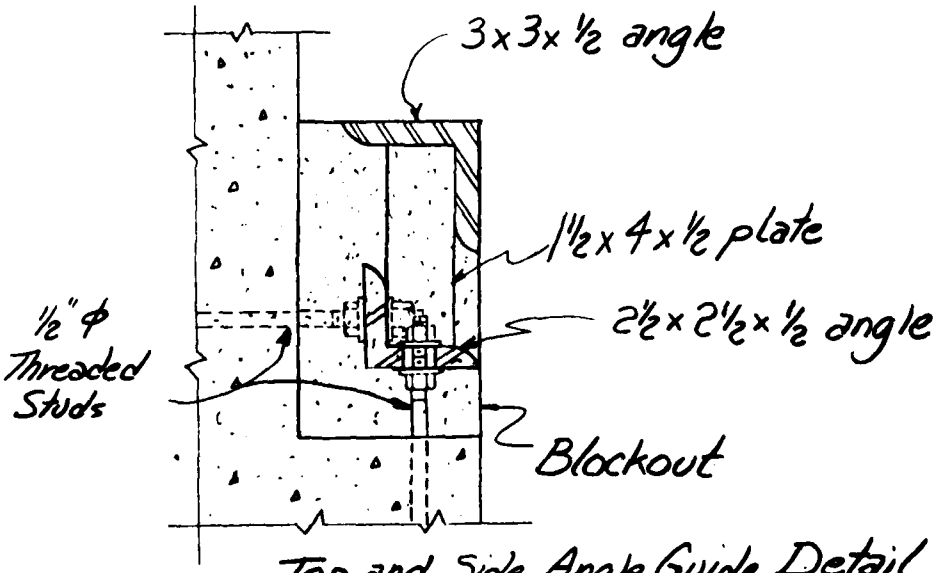
SCALE 3" = 1'-0"

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Valve Bulkhead Embedded Parts	PROJECT Lock and Dam No. 1
	COMPUTED _____ CHECKED _____	FILE NO. 800A
		DATE 1/75 PAGE ____ OF ____ PAGES



Sill Beam Detail scale ¼" = 1"



Top and Side Angle Guide Detail scale ¼" = 1"

PLATE H-9

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Upstream Lock Unwatering Bulkhead Sections COMPUTED ____ CHECKED ____	PROJECT Lock and Dam No. 1 FILE NO 800A DATE 1/75 PAGE ____ OF ____ PAGES

LAND LOCK

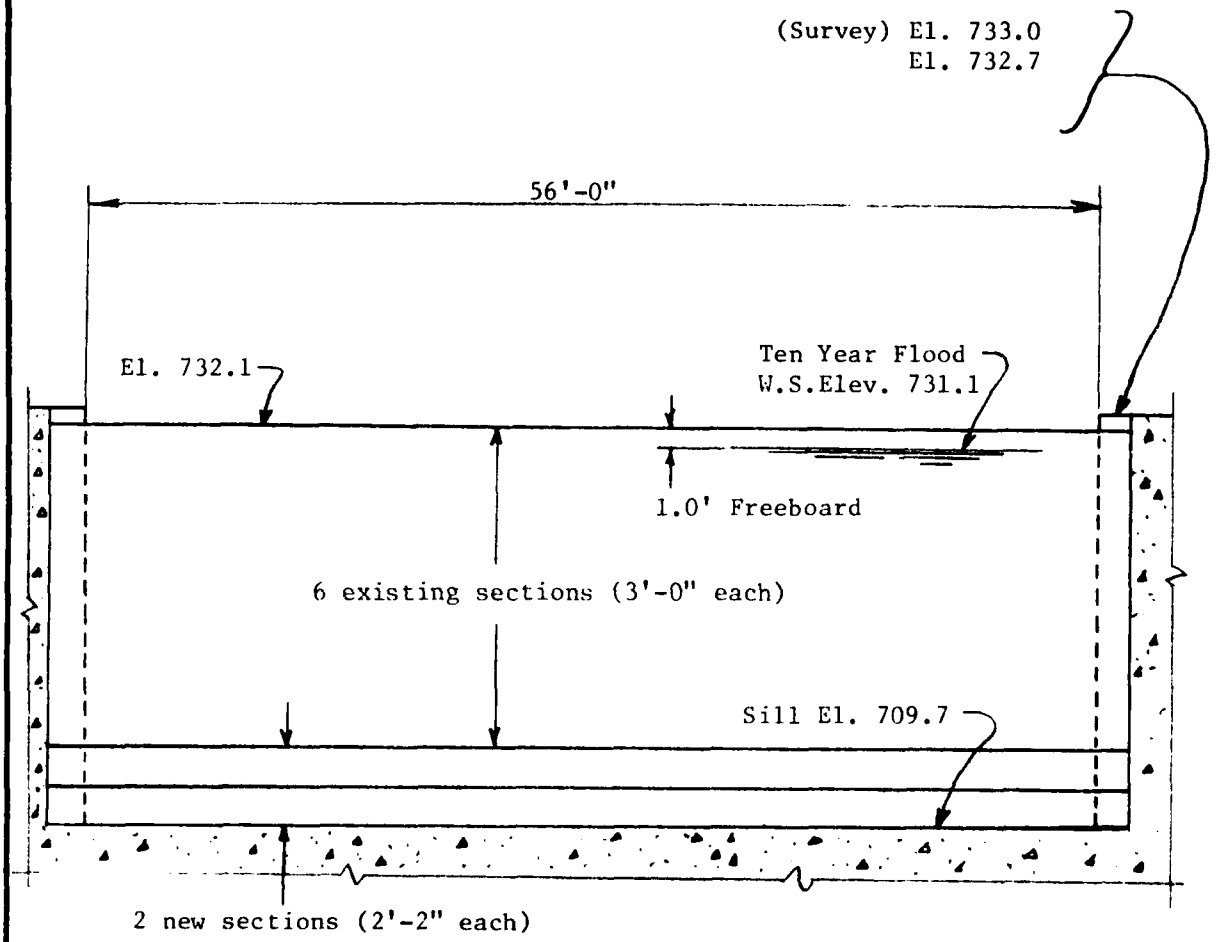


PLATE H-10

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Downstream Lock Unwatering Bulkhead Sections	PROJECT Lock and Dam No. 1
	COMPUTED ____ CHECKED ____	FILE NO 800A
		DATE 1/75 PAGE ____ OF ____ PAGES

LAND LOCK

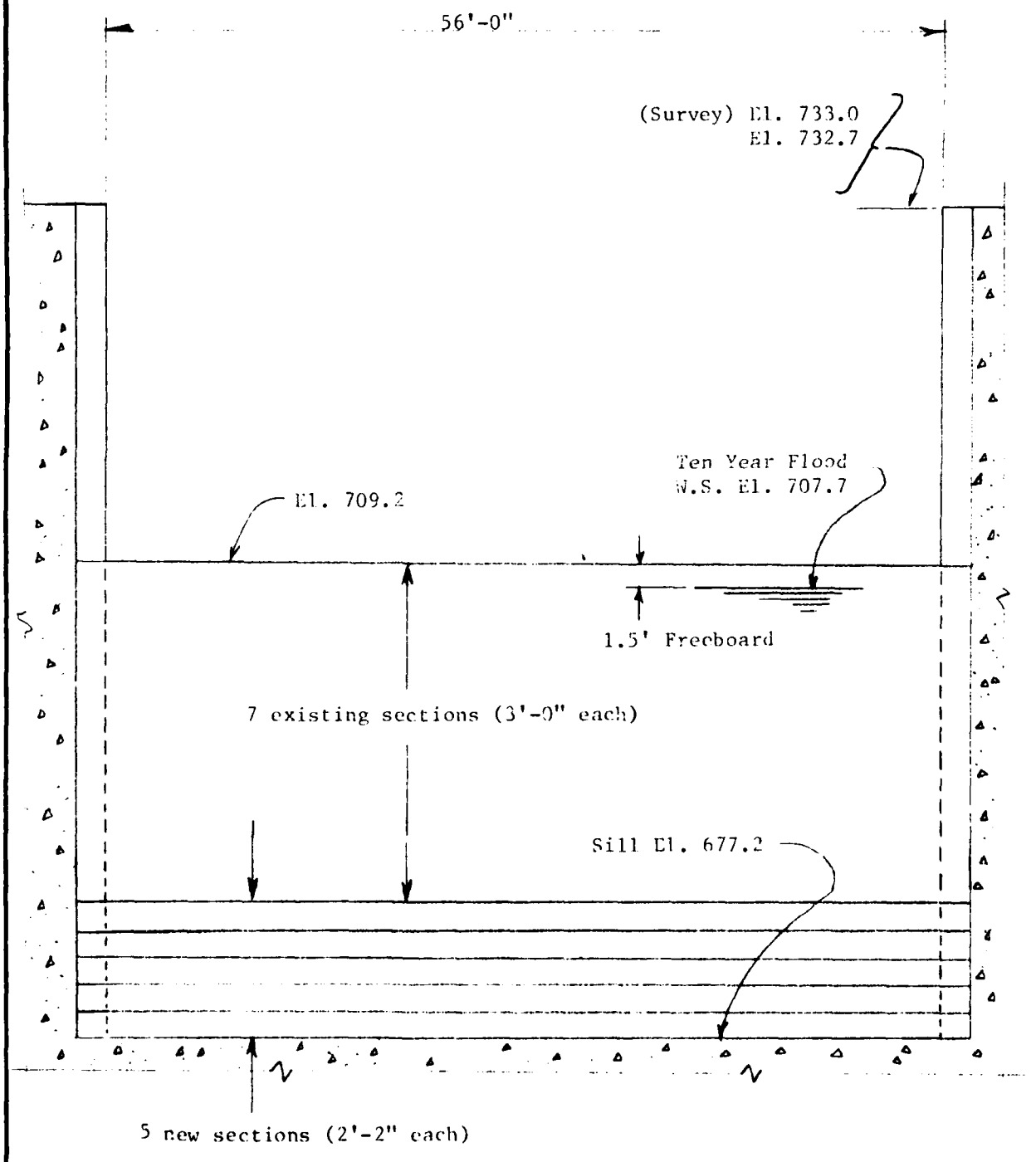


PLATE H-11

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Bulkhead Slot: New and Existing	PROJECT Lock and Dam No. 1
	COMPUTED ____ CHECKED ____	FILE NO 2004
		DATE 1/75 PAGE ____ OF ____ PAGES

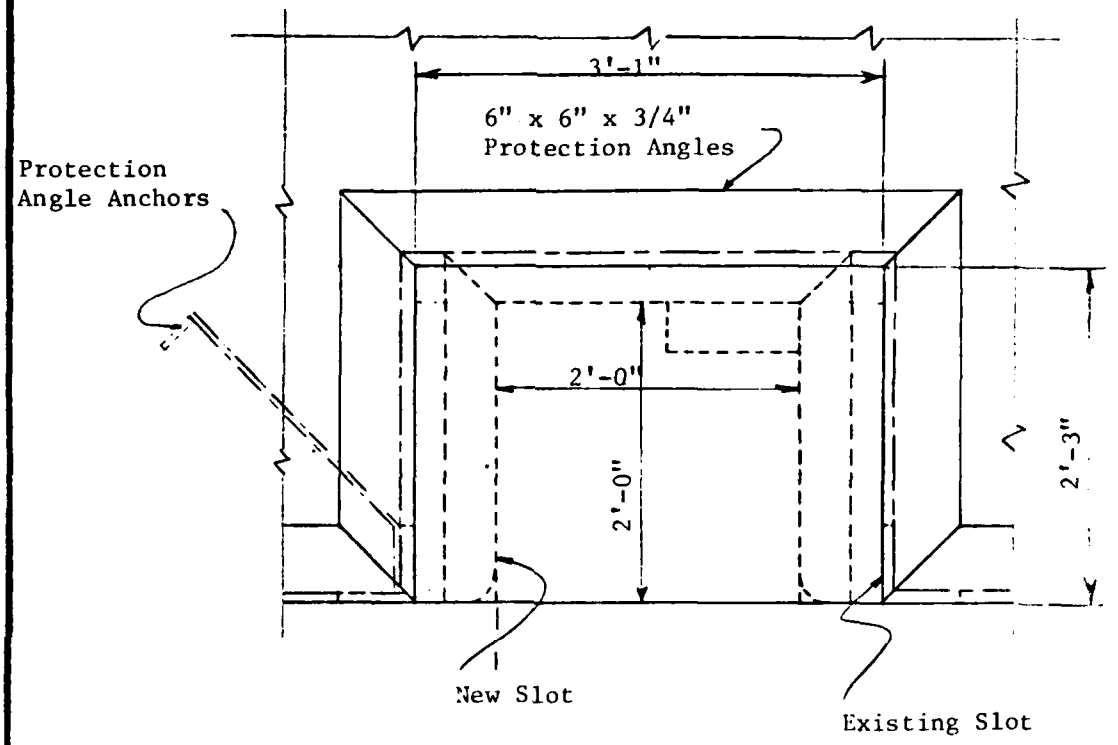


PLATE H-12

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Upstream Lock Bulkhead Slots	PROJECT Lock and Dam No. 1
		FILE NO 800A
	COMPUTED ____ CHECKED ____	DATE 1/75 PAGE ____ OF ____ PAGES

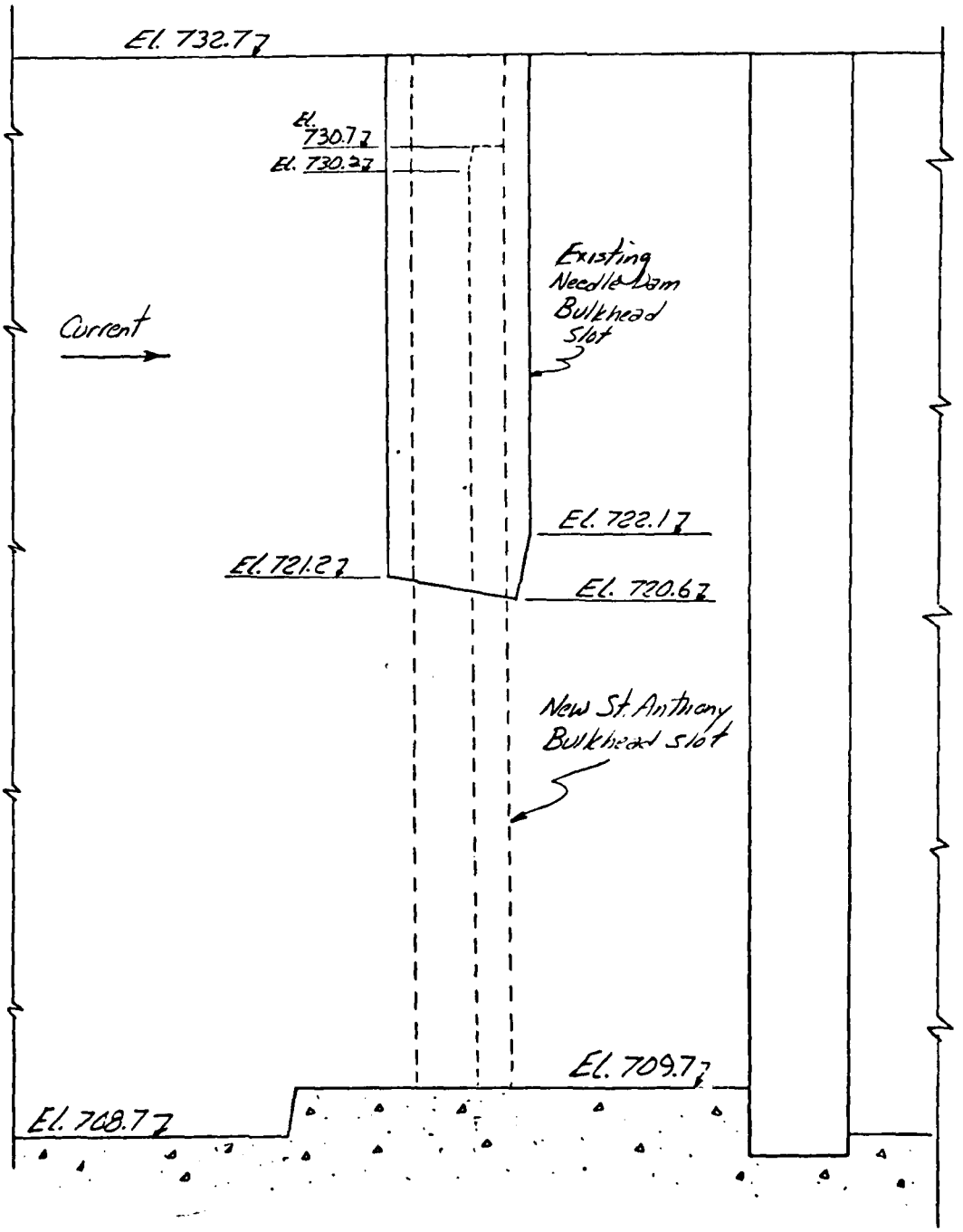


PLATE H-13

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Downstream Lock Bulkhead Slots	PROJECT Lock and Dam No. 1
	COMPUTED ____ CHECKED ____	FILE NO 800A
		DATE 1/75 PAGE ____ OF ____ PAGES

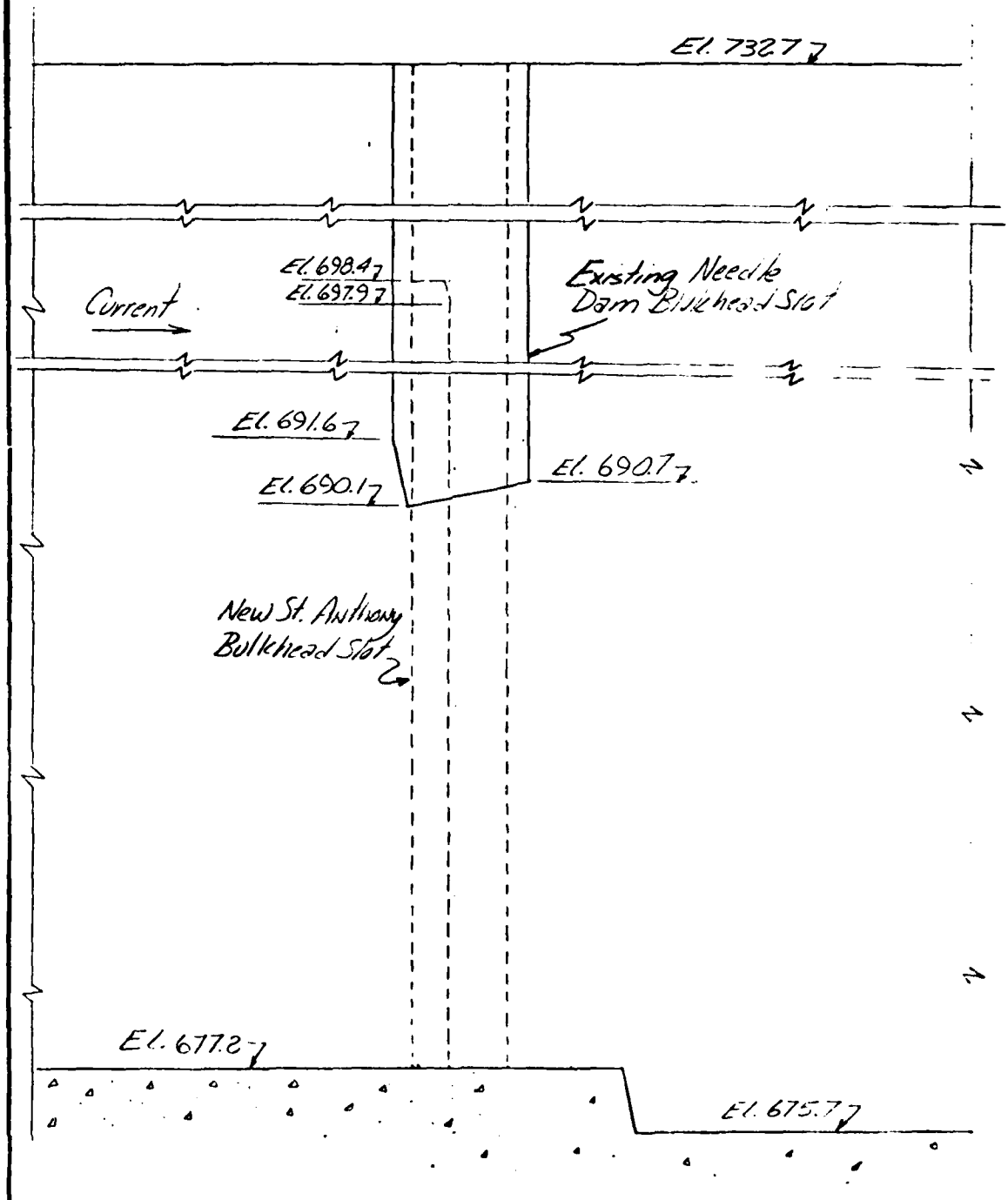
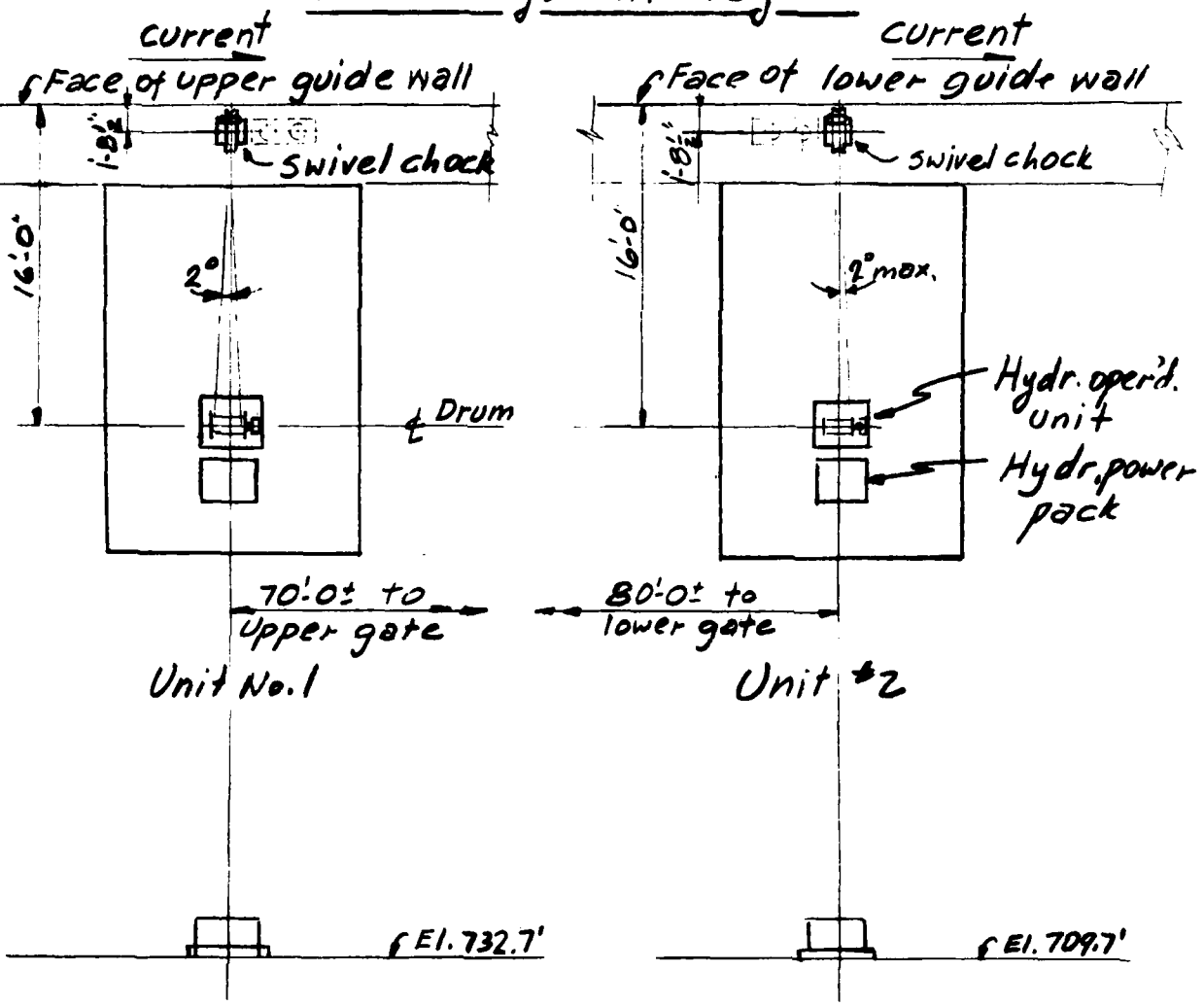


PLATE H-14

FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Tow Haulage Layout	PROJECT Lock and Dam No. 1
		FILE NO 800A
	COMPUTED ____ CHECKED ____	DATE 1/75 PAGE ____ OF ____ PAGES

Tow haulage unit layout



UPPER GUIDE WALL TOW HAULAGE UNIT

Scale: $\frac{1}{32}$" = 1'-0"

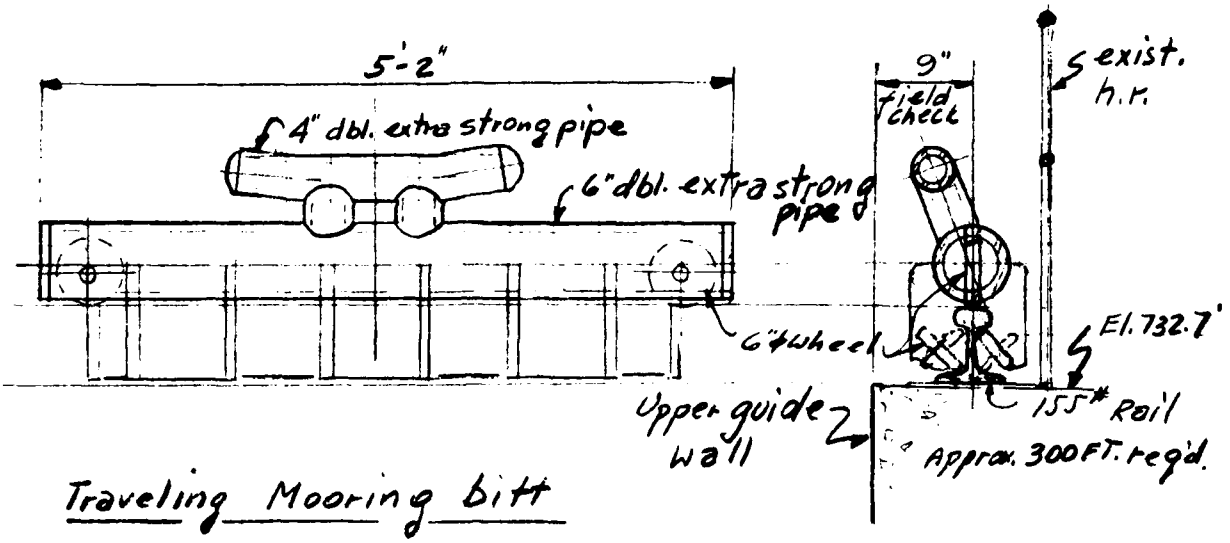
LOWER GUIDE WALL TOW HAULAGE UNIT

Scale: $\frac{1}{32}$" = 1'-0"

PLATE B-15

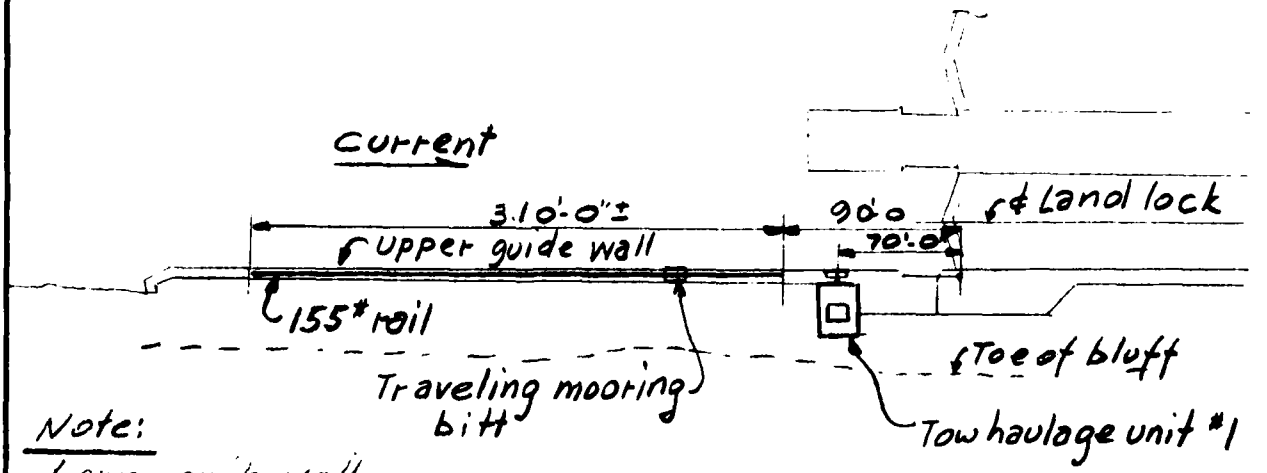
FOR USE ON U.S. GOVERNMENT WORK ONLY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Traveling Mooring Bitt Layout	PROJECT Lock and Dam No. 1
	COMPUTED ____ CHECKED ____	FILE NO 800A
		DATE 1/75 PAGE ____ OF ____ PAGES



Traveling Mooring bitt

Struct. stl. 300 lbs.
Black stl. pipe 400 lbs.
Scale: $\frac{3}{4}$" = 1'-0"



Note:
Lower guide wall installation similar

LAYOUT

Scale: 1" = 100'-0"

PLATE H-16

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1210 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER

STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1

MINNEAPOLIS, MINNESOTA

APPENDIX I

ELECTRICAL FEATURES

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APPENDIX I

ELECTRICAL FEATURES

1. Power Supply and Distribution

A. Source

Power supply at 480-V, 3-phase, 3-wire delta, 60-Hz would be obtained for lock operation at the hydro generating station operated by the Ford Motor Company, adjacent to the dam. Each of two supply feeders, the second provided for redundancy, sized for full load would extend from the station through the dam gallery and into the lock central control building. This supply system, similar to the system now in use, is preferred over an alternative for the following reasons:

1) Higher initial cost of alternative supply. An alternative supply from the landward side involves an estimated $20,000 utility charge for service facilities not now available at the landward lock. This cost is only partially offset by shorter feeder lengths compared with those from the hydro station.

2) Reliability. The reliability of the generating station is considered equal to or superior to other sources in the area. Service continuity for the relatively small electrical lock load could be easily maintained even with one generator out of service. With a total station outage, station interconnection with local distribution networks could be utilized for back feed of sufficient power to satisfy the lock demand. The reliability associated with protected feeders in the dam would be superior to that of the alternative supply which would necessarily involve some overhead lines.

3) Low Rate Structure. Based on 1973 rates the first annual 50,000 kwh of usage is free, and for the next 115,000 kwh of demand, the rate is 2.5 mil per kwh. Although increases may be expected in the future, low preferential rates for lock usage resulting from federal lease arrangement for the dam are extremely attractive. The applicable rates for the alternative source would necessarily be higher than the preferential rates.

4) Power supply for construction would be furnished by the contractor, from the local utility company.

B. Distribution Centers

Supply feeders would terminate at a distribution switchboard in the central control building. As shown on Plate I-1 the board could be equipped with dual service breakers, mechanically interlocked, a breaker for connection of emergency diesel supply, metering facilities, and branch circuit breakers for feeders to motor control centers. The motor control centers would be located in the central control, upstream and downstream control buildings, for supply to the power loads associated respectively, with the central, upstream and downstream locations. Lighting panel boards would also be included.

C. Feeders

Feeders would be conventional cable type, one circuit for each load singly fed.

D. Emergency Supply Provisions

An existing 90 kw diesel generating set could be utilized for emergency supply in the event of loss of supply from the hydro station, or flooding in the dam gallery or lock, preventing use of the normal supply.

2. Control Systems

A. Rehabilitated Lock (s)

1) Equipment Description and Operation. For cost estimating purposes each of the miter gates, and each of the valves or gates to be used for filling and emptying the lock chamber, has been assumed to be hydraulically operated by means of a separate variable displacement pump. The pump would be driven by a single-speed non-reversing a-c motor. Control would be obtained with a reversing a-c control motor, varying the pump displacement, and equipped with a braker for accurate positioning. Direction of travel would be obtained by means of a solenoid valve. Alternative controls should be no more costly.

Projected control equipment would consist of motor starters located in the motor control centers, control switches and indicating lights mounted in benchboards, and limit switches at the motors and brakes. Controls for upstream miter gates, and for the valves or gates for filling and emptying would be located in the upstream control building; similarly downstream control equipment would be in the downstream control building.

2) Miter Gate Control Scheme. Each leaf has been assumed to be independently controlled. Once initiated, opening or closing one miter gate leaf would be fully automatic in an established speed sequence. Movement could be stopped at any time. Interlocking is described below. Except for local switches at motors for testing, all control would be at the benchboard with position indicating lights.

3) Lock Chamber Filling and Emptying Valves or Gates Control Scheme. Each valve or gate has been assumed to be independently controlled. Selection of one of several speed sequences common to all gates or valves would be made. Once initiated, one gate or valve opening or closing would be completed at the preselected speed sequence. Movement would be stopped at any time. Interlocking is described below. Except for local switches at the motors for testing, all control and associated indicating lights would be mounted on the same benchboards as those for the miter gates.

4) Interlocking. Interlocking of controls is required to prevent operation of a miter gate under unbalanced head, to prevent flow through the lock unless both leafs of a miter gate are latched open or mitered closed, and to prevent flow through the lock resulting from the filling and emptying valves or gates being open at the same time.

5) Tow Haulage Unit. Control would consist of a local NEMA 4 combination motor starter and push button station. The drive would be a conventional squirrel cage a-c motor.

6) Mooring Bit. No power equipment is involved. A light would be furnished to illuminate the floating bit.

7) Alternative Control Equipment. Programmable controllers could be utilized in place of relays and timers for the miter gate and valve control. However, at the present state of the art such controllers would not be acceptable because operation could not be guaranteed below 0°F as would be required under certain conditions. For this reason costs were based on conventional control devices.

c. Improved Lock

New electrical equipment of the same type as now installed would be provided to improve operating life of the present riverward lock. The equipment would consist of conventional panelboards, motor starters, lighting equipment and a small amount of control

equipment. Because the lock is directly controlled by hydraulic levers there are relatively few electrical control devices.

3. Lighting

A. Traffic and Navigation Lights

These would consist of red, amber, and green traffic signals located on the upstream and downstream piers and guide walls operating with audible signals to direct river traffic in preparation of a boat entering and leaving a lock. Control of the lights would be from the control building benchboards and the Lockmaster's office in the central control buildings. Operating sequence of the warning system would be keyed to miter gate operation. A small boat signal would be included. Suitable navigation and nose lights would be provided on the upstream and downstream lock structures.

B. Lock Illumination

General illumination of the lock exterior would utilize conventional lighting standards with newer lighting forms such as metal halide or sodium vapor lamps. Decorative lighting was not included. Interior lighting of the control buildings could follow established patterns with fluorescent and incandescent fixtures.

4. Wiring Methods

Costs are based on conventional conduit and cable. Cables placed in existing and new trenches recessed in the lock surface would be protected by means of cable trays or troughs. Cables extended across the bridge could be in conduit or cable tray. All other cables would be in conduit.

5. Grounding

A completely interconnected system of copper cables would be provided to connect all neutral terminals, electrical equipment frames and enclosures, and other metal equipment and appurtenances. The interconnected system would be connected to main ground electrodes consisting of square copper plates embedded in or attached to the new hydraulic discharge manifolds, located downstream of the existing lock structure. This design will insure a grounding system with low resistance to absolute ground even with the lock chamber unwatered.

6. Miscellaneous

A. Cathodic Protection of Miter Gates

Protection would consist of selenium iron anodes placed at strategic locations on both sides of each gate, connected together and to rectifiers on the lock structure. This arrangement would automatically compensate for metal loss due to corrosion. The projected installation is similar to systems currently in use on the Ohio River. Alternatively, magnesium anodes would require continual replacement and offer less protection, although at lower initial cost.

B. Cable Crossing

A reinforced concrete bridge (see Appendix J, page J-1) would support cables crossing the lock for lock operation and power supply.

Three alternate methods for cable crossings considered were:

1) Embedded conduits, 2) Embedded conduits and manholes, and 3) Blockouts or niches in walls and floors. The alternates were objectionable as discussed below.

1) Although cable pulling tensions could be made tolerable with large radius conduit bends, there is no reliable means to prevent water accumulation in the conduits with possible freezing and eventual rupture of the system. 2) A variation of this option considered use of vertical conduit formations in the side walls of the lock with a manhole at the bottom of one or both formations, as a means of draining water from the conduits. However, the shaft space required as an access to the manholes was not acceptable structurally. 3) A final option of placing cables in niches recessed in the lock chamber walls and floor had been considered not acceptable by the U.S. Corps, due to the inability of replacing cables without dewatering the lock chamber.

C. Communication Raceway System

Conduits, trays, and other raceways required for intercommunication and radio systems would be provided, but the equipment and wiring has not been included as it will be installed by the Government.

D. Electric Heating

Circuits would be provided for electric heating elements utilized in heating of the central control building. Electric unit heaters have been included for heating upstream and downstream control buildings.

E. Power Outlets

Power outlets have been included for use of existing portable unwatering pumps.

F. Temporary Wiring

Temporary wiring required for construction needs would follow conventional patterns used by contractors. Temporary wiring for operation of permanent equipment at temporary locations pending completion of construction work would utilize substantially the same material and technique as for permanent work due to the importance of insuring continuity of lock operation during the remaining construction interval.

7. Electrical Estimate Comments

A. Materials

Prices were based on current quotations obtained from Chicago electrical supply companies, current catalogs, and by direct quotations.

B. Labor

Labor prices were based on an analysis of the required construction manhours and current wage rates.

C. Quantities

Take offs were used to establish the quantities, using as a cost model the St. Anthony Falls project.

D. Non Direct Costs

Escalation, contingencies, engineering and financing and similar costs were not included in the electrical cost estimate.

PANEL NO. [illegible]
PANEL TYPE: MOTOR CONTROL CENTER 480 V, 3 Ø, 3 WIRES
NO. OF CIRCUITS: [illegible]

LOCATION: [illegible]
MAIN BREAKER: [illegible]
SIZE OF BREAKERS: AS LISTED

DESIGNATION
Tie feeder
Emergency trip feeder
Miter gate leaf No. [illegible]
Miter gate leaf No. [illegible]
Valve No. 1A
Valve No. 1B
Navigation lights
Transformer for panelboard No. [illegible]
Transformer for panelboard No. [illegible]
Transformer for guide wall lights
Spare
Power receptacle
Control house heat
Power receptacle
[illegible]
[illegible]
Valve No. [illegible]
Valve No. [illegible]

PANEL NO. [illegible]
PANEL TYPE: MOTOR CONTROL CENTER 480 V, 3 Ø, 3 WIRES
NO. OF CIRCUITS: [illegible]

LOCATION: [illegible]
MAIN BREAKER: [illegible]
SIZE OF BREAKERS: AS LISTED

DESIGNATION
Tie feeder
Emergency trip feeder
Miter gate leaf No. [illegible]
Miter gate leaf No. 4
Valve No. [illegible]
Valve No. 4A
[illegible]
Transformer for panelboard No. [illegible]
Transformer for panelboard No. 4
Transformer of load. wall lights
Power receptacle
Control house heat
[illegible]
Receptacle
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
Receiving [illegible] No. 2

PANEL NO. [illegible]
PANEL TYPE: MOTOR CONTROL CENTER 480 V, 3 Ø, 3 WIRES
NO. OF CIRCUITS: [illegible]

LOCATION: CENTRAL CONTROL HOUSE
MAIN BREAKER: 400 AMP. [illegible]
SIZE OF BREAKERS: AS LISTED

BRANCH CKT NO	CKT POLES	BKR AMP	BKR FRAME SIZE	KVA	LOAD KW or HP	STARTER NEMA SIZE	AUX. CONTACTS EACH TYPE	OTHER EQUIPMENT (NOTES)	DESIGNATION
[illegible]	3	150	225		[illegible]			[illegible]	[illegible]
[illegible]		[illegible]	[illegible]						Transformer for panelboard No. [illegible]
[illegible]	3	[illegible]	[illegible]						Power receptacle
[illegible]	3	[illegible]	[illegible]		[illegible]			[illegible]	Building heat
[illegible]		[illegible]	[illegible]		[illegible]			[illegible]	Building heat
	3	[illegible]	[illegible]						Spare
	3	[illegible]	[illegible]						Spare
	3	[illegible]	[illegible]						Spare
	3	[illegible]	[illegible]						Spare
	3	175	225	3	90				Fire protection pump house
	3	175	225	3	90				Fire protection pump house
	3	175	225	3	90				Fire protection pump house

PANEL NO. [illegible]
PANEL TYPE: 120/240 V, 1 Ø, 3 WIRE
NO. OF CIRCUITS: [illegible]

LOCATION: [illegible]
MAIN BREAKER: [illegible] AMPERES
SIZE OF BREAKERS: 20 AMPERES

DESIGNATION	WATTS	DESIGNATION
Navigation and hose lights	[illegible]	Spare
[illegible] lights	[illegible]	Control house lights
Spare		Spare
Spare		Control house lights
[illegible] lights	[illegible]	Spare
Spare	531 750 750	Miter gate No. [illegible] heat
[illegible] heat	1000 1500 531 750 750	Miter gate No. [illegible] heat
Spare		Spare
[illegible]		Spare
[illegible] heater		Spare
[illegible] receptacles	800	Machinery niche receptacles
Spare		Spare
Spare	611	Receptacles at sta. [illegible]
SUBTOTAL	2900	SUBTOTAL
TOTAL		

PANEL NO. [illegible]
PANEL TYPE: [illegible] 3 WIRES
NO. OF CIRCUITS: [illegible]

LOCATION: CENTRAL CONTROL HOUSE
MAIN BREAKER: [illegible] AMPERES
SIZE OF BREAKERS: [illegible] AMPERES

DESIGNATION	WATTS	DESIGNATION
[illegible]	800	Spare
Machinery niche lights	[illegible]	Spare
Spare	612 750	Miter gate No. [illegible]
Valve No. [illegible] heat	[illegible] 531 750 750	Miter gate No. [illegible] heat
Spare		Spare
Machinery niche receptacles	800	Spare
Spare	613	Receptacles at sta. [illegible]
Spare		Spare
Spare	534 450	Path lights river side
Spare		Spare
Machinery niche lights	[illegible]	Spare
Spare	614 750 750	Miter gate No. 4 heat
Valve No. 4 heat	1500 1500 534 750 750	Miter gate No. 4 strut heat
Machinery niche receptacles	800	Spare
Spare		Spare
Spare	614	Receptacles at sta. 25, 28, 29
SUBTOTAL	[illegible]	SUBTOTAL
TOTAL	17,100	

PANEL NO. [illegible]
PANEL TYPE: 120/240 V, 1 Ø, [illegible]
NO. OF CIRCUITS: 36

DESIGNATION	WATTS
Spare	
[illegible] lights	
Parkway lights landside	
Spare	
Control house lights	400
Spare	
Machinery niche lights	500
Spare	
Valve [illegible] heat	1000
Navigation and hose lights	
Motor winding heaters	2000
Machinery niche recept.	
Spare	
Control house receptacles	
SUBTOTAL	4400
TOTAL	5,100

PANEL NO. [illegible]
PANEL TYPE: 120/240 V, 1 Ø, [illegible]
NO. OF CIRCUITS: 42

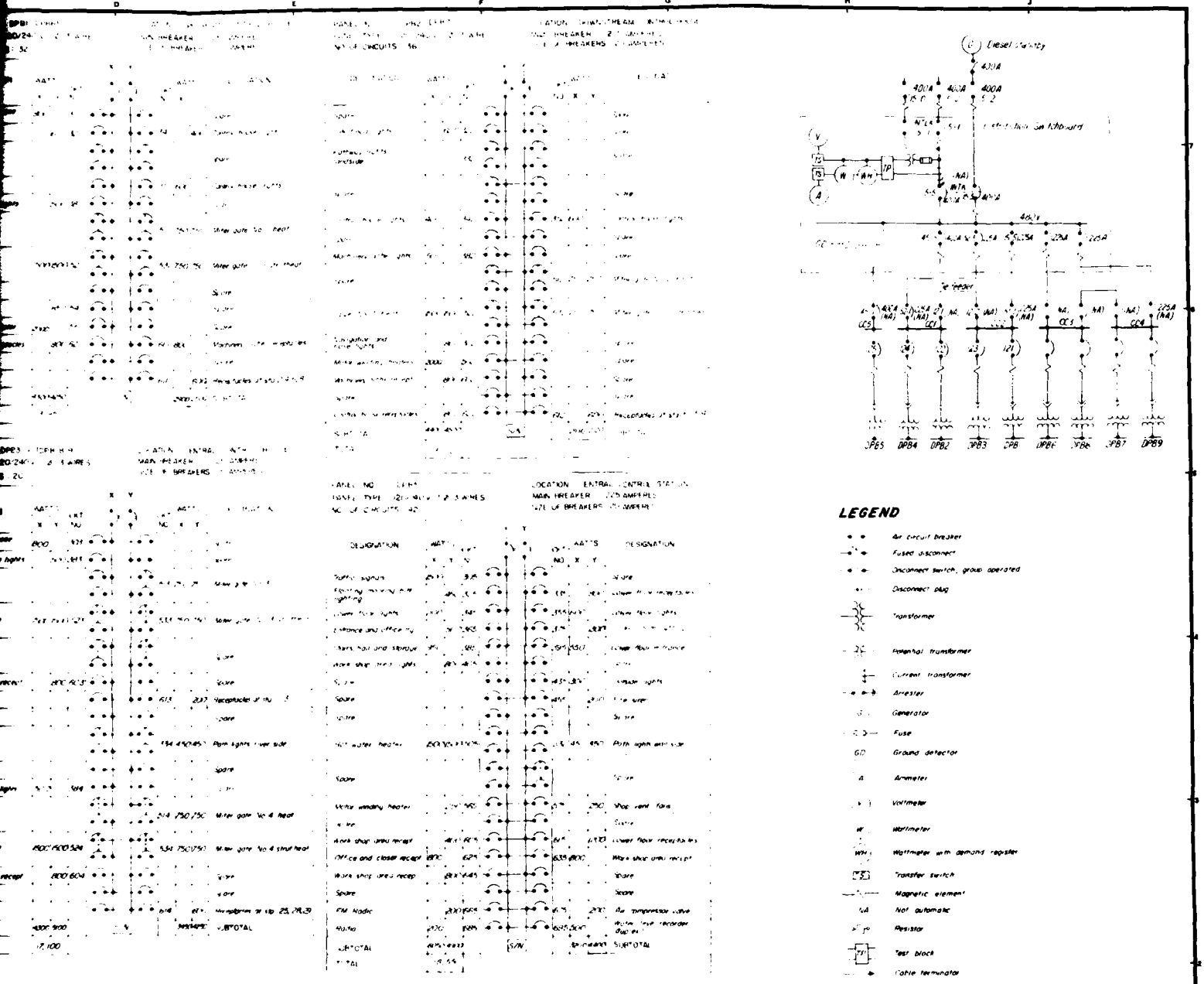
DESIGNATION	WATTS X	WATTS Y
Traffic signals	1500	
Floating mooring bitt lighting		
Lower floor lights	100	
Entrance and office lts		
Stairs hall and storage	950	
Work shop area lights		
Spare		
Spare		
Spare		
Hot water heater	1500	
Spare		
Motor winding heater		
Spare		
Work shop area recept.		
Office and closet recept.	1800	
Work shop area recept.		
Spare		
FM Radio		
Radio	200	
SUBTOTAL	[illegible]	
TOTAL	[illegible] 9,550	

INTERRUPTING CAPACITY SCHEDULE

TRIP CURRENT RANGE AMPERES	NORMAL FRAME SIZE AMPERES	SYSTEM VOLTAGE VOLTS	MINIMUM SYMMETRICAL RMS AMPERES	INTERRUPTING CAPACITY VOLTS
15 - 100	100	480	14,000	480
125 - 225	225	480	22,000	480
15 - 50	50	120/240	5,000	240
240 - 400	400	480	30,000	480

NOTES

1. Furnish auxiliary devices in compartments where indicated as required.
   - AR - Auxiliary relay
   - T - Control transformer
   - CNT - Contactor
   - TO - Thermal overload [illegible]
   - R, G, [illegible] - Red green indicating [illegible]
   - CM [illegible] - [illegible] motor [illegible] contacts and [illegible]
2. Non automatic breaker
3. For equipment control schematics see respective drawings.



LEGEND

- Air circuit breaker
- Fused disconnect
- Disconnect switch, group operated
- Disconnect plug
- Transformer
- Potential transformer
- Current transformer
- Arrester
- Generator
- Fuse
- GD — Ground detector
- A — Ammeter
- V — Voltmeter
- W — Wattmeter
- WH — Wattmeter with demand register
- TS — Transfer switch
- Magnetic element
- NA — Not automatic
- R — Resistor
- TB — Test block
- Cable terminator

NOTES

1. Furnish auxiliary devices in compartments where indicated and as required.
   - AC - Auxiliary relay
   - T - Control transformer
   - CR - Contactor
   - TOL - Thermal overload protection
   - G, R - Pilot green indicating lights fixed
   - F, R - Control motor forward reversing contacts and fuses
2. Non-automatic breaker
3. For equipment control schematics see respective drawings
4. Control circuit for motor control center starters, contactors and step controllers shall be 120 AC, 480/120 - Control transformers shall be furnished with each starter and the step controller in their respective compartments
5. For frame size of breakers, see circuit breaker schedule
6. Motor control centers and panelboards shown in parenthesis are for riverside lock
7. Panel designations shown in parenthesis apply to the rehabilitation riverside lock

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
ST PAUL, MINNESOTA

DESIGNED BY G. A. D.
DRAWN BY A. L.
CHECKED BY A. K. K.
SUBMITTED BY
APPROVED

STUDY OF ALTERNATIVES FOR REHABILITATION
MISSISSIPPI RIVER LOCK & DAM NO. 1

ELECTRICAL FEATURES
ONE-LINE DIAGRAM AND LOAD DISTRIBUTION TABULATIONS

DATE: MARCH 1975

DRAWING NUMBER

SHEET OF

PLATE 1

SAFETY PAYS

1 2

MISSISSIPPI RIVER

STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1

MINNEAPOLIS, MINNESOTA

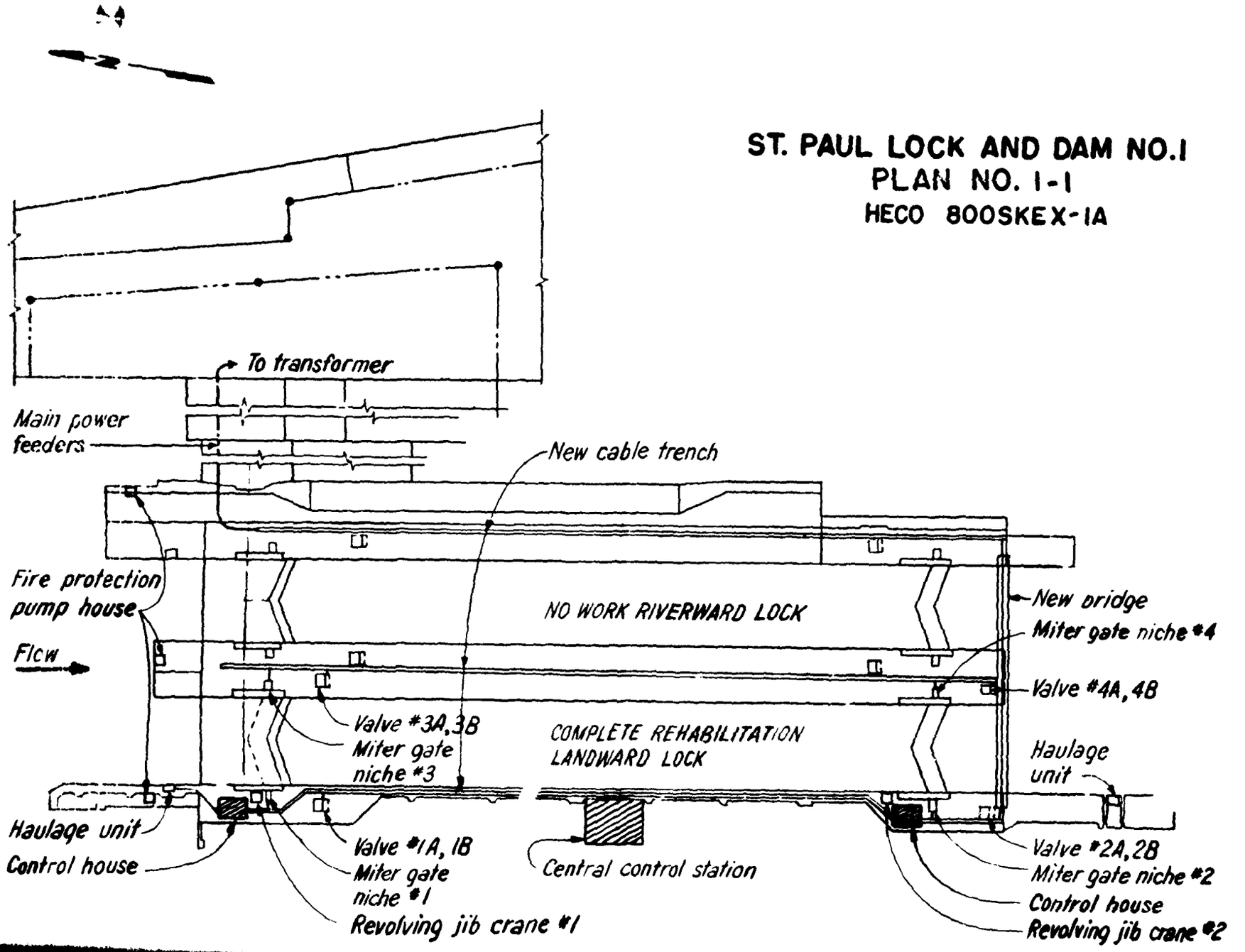
APPENDIX I

ELECTRICAL FEATURES

COST ESTIMATES

INDEX

ST. PAUL LOCK AND DAM NO.1
PLAN NO. 1-1
HECO 800SKEX-1A



ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

REV. 9/75

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 1 of 9 Pages

Structure ELECTRICAL, PLAN # 1-1 Estimated by GAD AKK Checked by DAH CRP

Item No.	ITEM	Quantity	Unit Price	Amount
	VALVES & JIB CRANES			2 000 00
	FIRE PROTECTION			21 301 00
	PAGE 2			97 123 00 ✓
	PAGE 3			16 [illegible] ✓
	PAGE 4			31 845 00 ✓
	PAGE 5			[illegible] ✓
	PAGE 6			153 676 00 ✓
	PAGE 7			3 168 00 ✓
	PAGE 8			68 564 00 ✓
	PAGE 9			35 500 00 ✓
1	TOTAL (LANDWARD LOCK)			440 444 00
2	TOTAL (RIVERWARD LOCK)	NO WORK		———
3	REMOVAL OF EXISTING INSTALLATION			3 000 00
	TOTAL 1, 2 AND 3			443 444 00
	OVERHEAD AND PROFIT 25%			110 861 00
	SUB-TOTAL			$554 305 00
	CONTINGENCY 10%			55 430 00
	GRAND TOTAL		$	609 735 00
	USE			610 000 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 2 of 9 Pages

Structure ELECTRICAL PLAN # 1-1 Estimated by AKK Checked by RRR

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9200.00	9 20 00
B	MOTOR CONTROL CENTER (CC3)	1	8660.00	8 66 00
C	MOTOR CONTROL CENTER (CC1) WITH UNIT HEATER	1	17300.00	17 30 00
D	MOTOR CONTROL CENTER (CC2) WITH UNIT HEATER	1	20200.00	20 20 00
E	LIGHTING PANEL (DPB1)	1	725.00	725 00
F	LIGHTING PANEL (DPB2)	1	740.00	740 00
G	LIGHTING PANEL (DPB3)	1	610.00	610 00
H	LIGHTING PANEL (DPB4)	1	870.00	870 00
I	LIGHTING PANEL (DPB5)	1	820.00	820 00
J	TRANSFORMER			
1J	400 AMP ACBS 3POLE 480V	1	1300.00	1 300 00
2J	LIGHTING TRANSFORMER 15KVA	5	690.00	3 450 00
3J	LIGHTING TRANSFORMER 3KVA	3	216.00	648 00
K	UPSTREAM CONTROL DESK (CD1)	1	15,500.00	15 500 00
L	DOWNSTREAM CONTROL DESK (CD2)	1	15,500.00	15 500 00
M	TRAFFIC PANEL	1	1,600.00	1 600 00
				97 123 00 ✓

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Object ST. PAUL LOCK AND DAM #1 Date 12/74 Page 3 of 9 Pages

Structure ELECTRICAL, PLAN # 1-1 Estimated by AKK Checked by CLC

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL (LMCP)	1	5,950.00	5950 00
O	HAULAGE UNIT	2	1,200.00	2400 00
P	REMOTE CONTACTOR			
1P	NEMA SIZE 0, 2 POLE IN NEMA 4 ENCLOSURE	4	140.00	560 00
Q	DISCONNECT PLUGS AND RECEPTACLE			
1Q	200 AMPS, 600V, 3W, 3P	1	420.00	420 00
2Q	100 AMPS, 600V, 3W, 3P	6	240.00	1440 00
3Q	60 AMPS, 600V 2W, 3P without Plug	3	80.00	240 00
4Q	60 AMPS, 600V 2W, 2P	5	144.00	720 00
5Q	30 AMPS, 600V 3W, 3P	17	84.00	1428 00
6Q				
7Q	20 AMPS, 600V, 2W, 2P	5	80.00	400 00
8Q	15 AMPS, 125V, 3W, 3P	5	36.00	180 00
9Q	15 AMPS, 125V, 3W, 2P	13	32.00	416 00
10Q	15 AMPS, 125V, 3W, 2P	20	30.00	600 00
11Q	15 AMPS, 125V, 3W, 2P DUPLEX	36	30.00	1080 00
12Q	15 AMPS, 125V, 3W, 2P DUPLEX W.P. BOX	16	30.00	480 00
				[illegible]

ESTIMATE **HARZA ENGINEERING COMPANY** **E**
CHICAGO, ILLINOIS

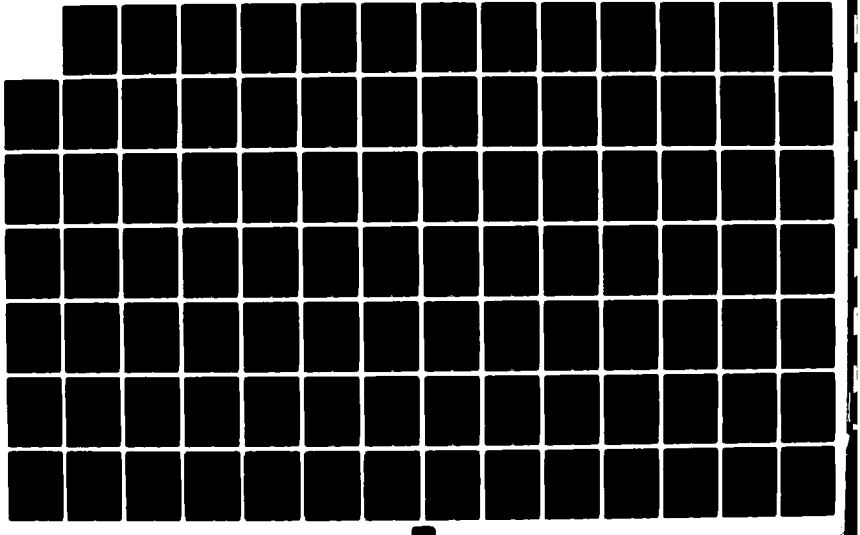
Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 4 of 9 Pages

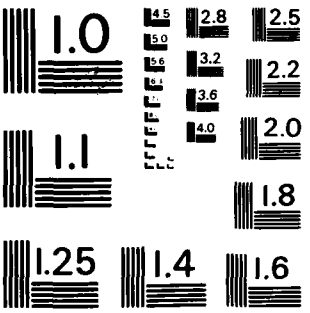
Structure ELECTRICAL PLAN #1-1 Estimated by AKK Checked by CPR

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCHES			
1R	15A, 125V SINGLE POLE SINGLE THROW	30	30.00	900 00
2R	15A, 125V SPST IN WEATHERPROOF BOX	20	35.00	700 00
3R	TRANSFER SWITCH IN NEMA 4 ENCL	17	100.00	1 700 00
S	MISCELLANEOUS ITEMS			
1S	WATER LEVEL TRANSMITTER	2	1,700.00	3 400 00
2S	BELL & HORN			
	4" & 10 VOLT INDOOR	1	20.00	20 00
	10" 115 VOLT OUTDOOR	1	85.00	85 00
	TWO WAY HORN	1	105.00	105 00
	HORN 125VDC, 110DB	1	115.00	115 00
T	LIGHTING			
	POLE LIGHTING			
	TYPE A	14	840.00	11 760 00
	TYPE B	9	840.00	7 560 00
	TYPE D	1	1400.00	1 400 00
	TYPE E	1	1400.00	1 400 00
	TYPE F	1	1400.00	1 400 00
	TYPE C	1	1300.00	1 300 00

AD-A134 024 MISSISSIPPI RIVER: STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND D..(U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT APR 76 2/3

UNCLASSIFIED F/G 13/2 NL





ESTIMATE HARZA ENGINEERING COMPANY CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM # 1 Date 12/74 Page 5 of 9 Pages

Structure ELECTRICAL PLAN # 1-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
T	LIGHTING (CONTINUED)			
	TYPE H	2	1150.00	2300 00
	FLUORESCENT AND INCANDESCENT FIXTURES			
	TYPE A	8	113.00	904 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1482 00
	TYPE D	10	35.00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	6	40.00	240 00
	TYPE H	4	35.00	140 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE - HIND VDA 2857	2	50.00	100 00
	CROUSE - HIND WEATHER RESISTANT	16	40.00	640 00
	CROUSE - HIND WEATHER RESISTANT	4	40.00	160 00
	FLOOD LIGHT 1500W REVERE	16	70.00	1120 00
	FLOATING MOORING (SIT LIGHTS	3	210.00	630 00
	EMERGENCY LIGHT UNIT	3	275.00	825 00
	LAMPS			
	40 W FLU.	62	1.70	105 40
	150W INCAND.	58	1.00	58 00
	100W INCAND	60	0.70	42 00
	60W INCAND	30	0.62	18 60
				9958 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Job ST. PAUL LOCK AND DAM #1 Date 12/74 Page 6 of 9 Pages

Structure ELECTRICAL, PLAN #1-1 Estimated by AKIC Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
V	JUNCTION BOXES			
1V	JBG1,2,3,4 ; JBV1,2,3,4 ; JB 3,4 NEMA 4 ENCLOSURE WITH TB	10	425.00	4 250 00
2V	JB 1,2 NEMA 1 ENCL. WITH TB	2	50.00	100 00
3V	OTHER BOXES	LS	1000.00	1 000 00
W	CABLE AND WIRES			
	1/c - 1/0 AWG	1,700 FT	1.60	2 720 00
	1/c - 500 MCM	13,500 "	4.10	55 350 00
	1/c - 4/0 AWG	1,800 "	2.35	4 230 00
	1/c - 1 AWG	1,700 "	1.18	2 006 00
	1/c - 4 AWG	11,500 "	0.75	8 625 00
	1/c - 6 AWG	10,000 "	0.55	5 500 00
	1/c - 8 AWG	5,000 "	0.32	1 600 00
	1/c - 10 AWG	3,000 "	0.25	750 00
	1/c - 12 AWG	8,000 "	0.19	1 520 00
	1/c - 14 AWG	1,200 "	0.13	156 00
	2/c - 10	2,500 "	0.58	1 450 00
	3/c - 10	1,600 "	0.91	1 456 00
	4/c - 10	1,800 "	1.20	2 160 00
	2/c - 12	6,000 "	0.42	2 520 00
	3/c - 12	2,300 "	0.70	1 610 00
	4/c - 12	200 "	0.83	166 00
	6/c - 12	6,000 "	1.23	7 380 00
	9/c - 12	9,000 "	1.80	16 200 00
	12/c - 12	15,000 "	2.17	32 550 00
	24/c - 12	100 "	3.75	375 00
				155 167 00

ESTIMATE HARZA ENGINEERING COMPANY CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 7 of 9 Pages

Structure ELECTRICAL, PLAN #1-1 Estimated by ARK Checked by CRR

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLES AND WIRES (CONT.)			
	2/c - 14 AWG	1200 FT	0.31	372 00
	3/c - 14 AWG	100 "	0.46	46 00
	FLEXIBLE CABLE			
	2/c - 6 AWG	100 "	2.60	260 00
	3/c - 6 AWG	100 "	3.50	350 00
	4/c - 6 AWG	100 "	4.20	420 00
	2/c - 8 AWG	100 "	2.20	220 00
	3/c - 8 AWG	100 "	2.60	260 00
	2/c - 12 AWG	800 "	1.20	960 00
	3/c - 12 AWG	200 "	1.40	280 00
				3168 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 8 of 9 Pages

Structure ELECTRICAL PLAN #1-1 Estimated by AICK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	3"	3200 FT	8.65	27 680 00
	2"	2200 "	5.27	11 594 00
	1½"	1000 "	3.40	3 400 00
	1¼"	500 "	2.65	1 325 00
	1"	1000 "	2.14	2 140 00
	¾"	2500 "	1.72	4 300 00
	ALLOWANCE FOR CONCRETE CUTTING	1	—	5 000 00
	FLEXIBLE CONDUITS			
	2"	50 "	8.60	430 00
	1½"	100 "	7.00	700 00
	1"	100 "	3.80	380 00
	¾"	100 "	3.25	325 00
Y	CONNECTIONS			
1Y	MOTOR	16	50.00	800 00
2Y	LIMIT SWITCH	8	300.00	2 400 00
3Y	LIMIT SWITCH	4	50.00	200 00
Z	TRENCH AND HANDHOLES			
AA	EXPANSION JOINTS			
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	1,500 FT	3.60	5 400 00
	410 AWG	500 "	2.10	1 050 00
	4 AWG	2,200 "	0.70	1 540 00
2AB	GROUND PLATE	6	150.00	900 00
				69 364 00

ESTIMATE

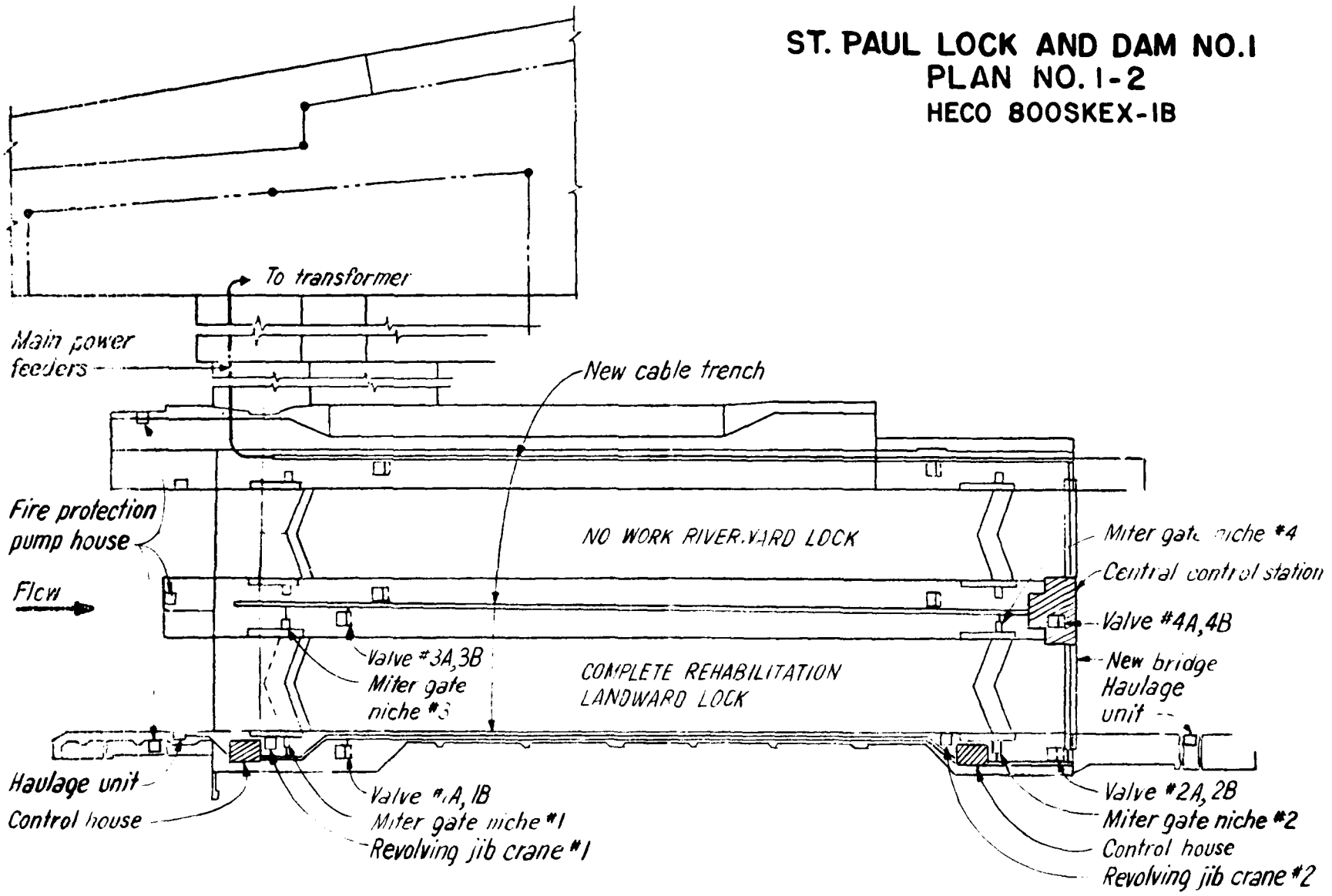
HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 9 of 9 Pages

Structure ELECTRICAL PLAN # 1-1 Estimated by AKK Checked by RRC

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATES	LS	500.00	500 00
AD	WELDING	LS	2000.00	2 000 00
AE	STRUCTURAL STEEL	LS	2000.00	2 000 00
AF	PAINTING	LS	2000.00	2 000 00
AG	TESTING AND INSPECTION	LS	5000.00	5 000 00
AH	CATHODIC PROTECTION OF WATER GATES	LS	24000.00	24 000 00
				35500 00

ST. PAUL LOCK AND DAM NO.1
PLAN NO. 1-2
HECO 800SKEX-1B



ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

REV. 9/75

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 1 of 9 Pages

Structure ELECTRICAL PLAN #1-2 Estimated by GAD AKL Checked by DAH ERC

Item No.	ITEM	Quantity	Unit Price	Amount
	VALVES & JIB CRANES			2 000 00
	FIRE PROTECTION			21 301 00
	PAGE 2			97 123 00 ✓
	PAGE 3			15 334 00 ✓
	PAGE 4			31 845 00 ✓
	PAGE 5			9 953 00 ✓
	PAGE 6			157 871 00 ✓
	PAGE 7			3 168 00 ✓
	PAGE 8			68 604 00 ✓
	PAGE 9			35 500 00 ✓
1	TOTAL (LANDWARD LOCK)			441 179 00
2	TOTAL (RIVERWARD LOCK)	NO WORK		—
3	REMOVAL OF EXISTING INSTALLATION			3 000 00
	TOTAL 1, 2 AND 3			444 179 00
	OVERHEAD AND PROFIT 25%			111 044 00
	SUB-TOTAL			555 223 00
	CONTINGENCY 10%			55 522 00
	GRAND TOTAL		$	610 745 00
	USE			615 000 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM Date 12/74 Page 2 of 9 Pages

Structure ELECTRICAL PLAN # 1-2 Estimated by AKK Checked by CRR

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9,200.00	9 20000
B	MOTOR CONTROL CENTER (CC5)	1	8,660.00	8 66000
C	MOTOR CONTROL CENTER (CC1) WITH UNIT HEATER	1	17300.00	17 30000
D	MOTOR CONTROL CENTER (CC2) WITH UNIT HEATER	1	20200.00	20 20000
E	LIGHTING PANEL (DPB1)	1	725.00	72500
F	LIGHTING PANEL (DPB2)	1	740.00	74000
G	LIGHTING PANEL (DPB3)	1	610.00	61000
H	LIGHTING PANEL (DPB4)	1	870.00	87000
I	LIGHTING PANEL (DPB5)	1	820.00	82000
J	TRANSFORMER			
J	400AMPS ACBS 3 POLE 480V	1	1,300.00	1 30000
J2	LIGHTING TRANSFORMER 15KVA	5	690.00	3450 00
J3	LIGHTING TRANSFORMER 3KVA	3	216.00	64800
K	UPSTREAM CONTROL DESK (CD1)	1	15,500.00	15 50000
L	DOWNSTREAM CONTROL DESK (CD2)	1	15,500.00	15 50000
M	TRAFFIC PANEL	1	1,600.00	1 60000
				97 12300 ✓

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 3 of 9 Pages

Structure ELECTRICAL PLAN #1-2 Estimated by AKK Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL (LMCP)	1	5,950.00	5950 00
O	HAULAGE UNIT	2	1,200.00	2400 00
P	REMOTE CONTACTOR			
1P	NEMA SIZE 0, 2 POLE IN NEMA 4 ENCLOSURE	4	140.00	560 00
Q	DISCONNECT PLUGS AND RECEPTACLE			
1Q	200 AMPS 600V 3W 3P	1	420.00	420 00
2Q	100 AMPS 600V 3W 3P	6	240.00	1440 00
3Q	60 AMPS 600V 3W 3P without Plug	3	80.00	240 00
4Q	60 AMPS 600V 3W 3P	5	144.00	720 00
5Q	30 AMPS 600V 3W 3P	17	84.00	1428 00
6Q				
7Q	20 AMPS 600V 2W 2P	5	80.00	400 00
8Q	15 AMPS 25V 3W 3P	5	36.00	180 00
9Q	15 AMPS 600V 3W 2P	13	32.00	416 00
10Q	15 AMPS 125V 3W 2P	20	30.00	600 00
11Q	15 AMPS 125V 3W 2P DUPLEX	36	30.00	1080 00
12Q	15 AMPS 125V 3W 2P DUPLEX IN WP BOX	16	30.00	480 00
				16316 00 ✓

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

oject ST PAUL LOCK AND DAM #1 Date 12/14 Page 4 of 9 Pages

Structure ELECTRICAL, PLAN #1-2 Estimated by AKK Checked by CDC

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCHES			
1R	15A, 125V SPST	30	30.00	900 00
2R	15A, 125V SPST IN WEATHERPROOF BOX	20	35.00	700 00
3R	TRANSFER SWITCH IN NEMA 4 ENCL	17	100.00	1700 00
S	MISCELLANEOUS ITEMS			
1S	WATER LEVEL TRANSMITTER	2	1700.00	3400 00
2S	BELL & HORN			
	4" 8-10 VOLT INLOCK	1	20.00	20 00
	10" 115 VOLT OUTDOOR	1	85.00	85 00
	TWO WAY HORN	1	105.00	105 00
	HORN 125V DC 110DB	1	115.00	115 00
T	LIGHTING			
	POLE LIGHT			
	TYPE A	14	840.00	11760 00
	TYPE B	9	840.00	7560 00
	TYPE D	1	1400.00	1400 00
	TYPE E	1	1400.00	1400 00
	TYPE F	1	1400.00	1400 00
	TYPE G	1	1300.00	1300 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLAN # 1-2 Estimated by AKK Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
I	LIGHTING (CONTINUED)			
	TYPE H	2	1150.00	2300 00
	FLUORESCENT AND INCANDESCENT FIXTURE			
	TYPE A	8	113.00	904 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1482 00
	TYPE D	10	35.00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	6	40.00	240 00
	TYPE H	4	35.00	140 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE HIND VQA 2857	2	50.00	100 00
	CROUSE HIND WEATHER RESISTANT	16	40.00	640 00
	CROUSE HIND WEATHER RESISTANT	4	40.00	160 00
	FLOOD LIGHT 150W REVERSIBLE	16	70.00	1120 00
	FLOATING MOORING BITT LIGHTS	3	210.00	630 00
	EMERGENCY LIGHT UNIT	3	275.00	825 00
	LAMPS			
	40W FLU	62	.70	105 40
	150W INCAND.	58	1.00	58 00
	100W INCAND.	60	0.70	42 00
	60W INCAND	30	0.62	18 60
				9953 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 6 of 9 Pages

Structure ELECTRICAL PLAN #1-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
V	JUNCTION BOXES			
IV	JBG1,2,3,4 ; JBV1,2,3,4 ; JB3,4 NEMA 4 ENCLOSURE WITH TB	10	425.00	4 25000
2V	JB 1,2 NEMA 1 ENCL WITH TB	2	50.00	100 00
3V	OTHER BOXES	LS	1000.00	1 000 00
W	CABLE AND WIRES			
	1/c - 500	12,000 FT	4.10	49 200 00
	1/c 4/0	3,100 "	2.35	7 285 00
	1/c - 1/0	1,700 "	1.60	2 720 00
	1/c - 1	1,700 "	1.18	2 006 00
	1/c - 4	9,500 "	0.75	7 125 00
	1/c - 6	13,500 "	0.55	7 425 00
	1/c - 8	12,500 "	0.32	4 000 00
	1/c - 10	3,000 "	0.25	750 00
	1/c - 12	8,000 "	0.19	1 520 00
	1/c - 14	1,200 "	0.13	156 00
	2/c - 10	2,500 "	0.58	1 450 00
	3/c - 10	1,800 "	0.81	1 458 00
	4/c - 10	1,000 "	1.20	1 200 00
	2/c - 12	6,000 "	0.42	2 520 00
	3/c 12	2,300 "	0.70	1 610 00
	4/c - 12	200 "	0.83	166 00
	6/c - 12	6,000 "	1.23	7 380 00
	9/c - 12	9,000 "	1.80	16 200 00
	12/c - 12	17,500 "	2.17	37 975 00
	24/c 12	500 "	3.75	1 875 00
				157 811 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM # 1 Date 12/74 Page 7 of 9 Pages

Structure ELECTRICAL PLAN # 1-2 Estimated by AKK Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLES AND WIRES (CONT.)			
	2/c - 14 AWG	1200 FT	0.31	372 00
	3/c - 14	100 "	0.46	46 00
	FLEXIBLE CABLE			
	2/c - 6 AWG	100 "	[illegible]	260 00
	3/c - 6	100 "	[illegible]	350 00
	4/c - 6	100 "	[illegible]	420 00
	2/c - 8	100 "	[illegible]	220 00
	3/c - 8	100 "	[illegible]	260 00
	2/c - 12	800 "	[illegible]	960 00
	3/c - 12	200 "	1.40	280 00
				3 168 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 8 of 9 Pages

Structure ELECTRICAL, PLAN #1-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	3"	2,800 FT	8.65	24 220 00
	2"	2,200 "	5.27	11 594 00
	1½"	1,000 "	3.40	3 400 00
	1¼"	500 "	2.65	1 325 00
	1"	1,000 "	2.14	2 140 00
	3/4"	2,500 "	1.72	4 300 00
	ALLOWANCE FOR CONCRETE CUTTING	1	-	5 000 00
	FLEXIBLE CONDUITS			
	2"	50 "	8.60	430 00
	1½"	100 "	7.00	700 00
	1"	100 "	3.80	380 00
	3/4"	100 "	3.25	325 00
Y	CONNECTIONS			
1Y	MOTOR	16	50.00	800 00
2Y	LIMIT SWITCH	8	300.00	2 400 00
3Y	LIMIT SWITCH	4	50.00	200 00
Z	TRENCH AND HANDHOLES	—	—	—
AA	EXPANSION JOINTS	—	—	—
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	1,500 FT	3.60	5 400 00
	4/0 AWG	500 "	2.10	1 050 00
	4 AWG	2,200 "	0.70	1 540 00
2AB	GROUND PLATE	6	150.00	900 00
				65 104 00

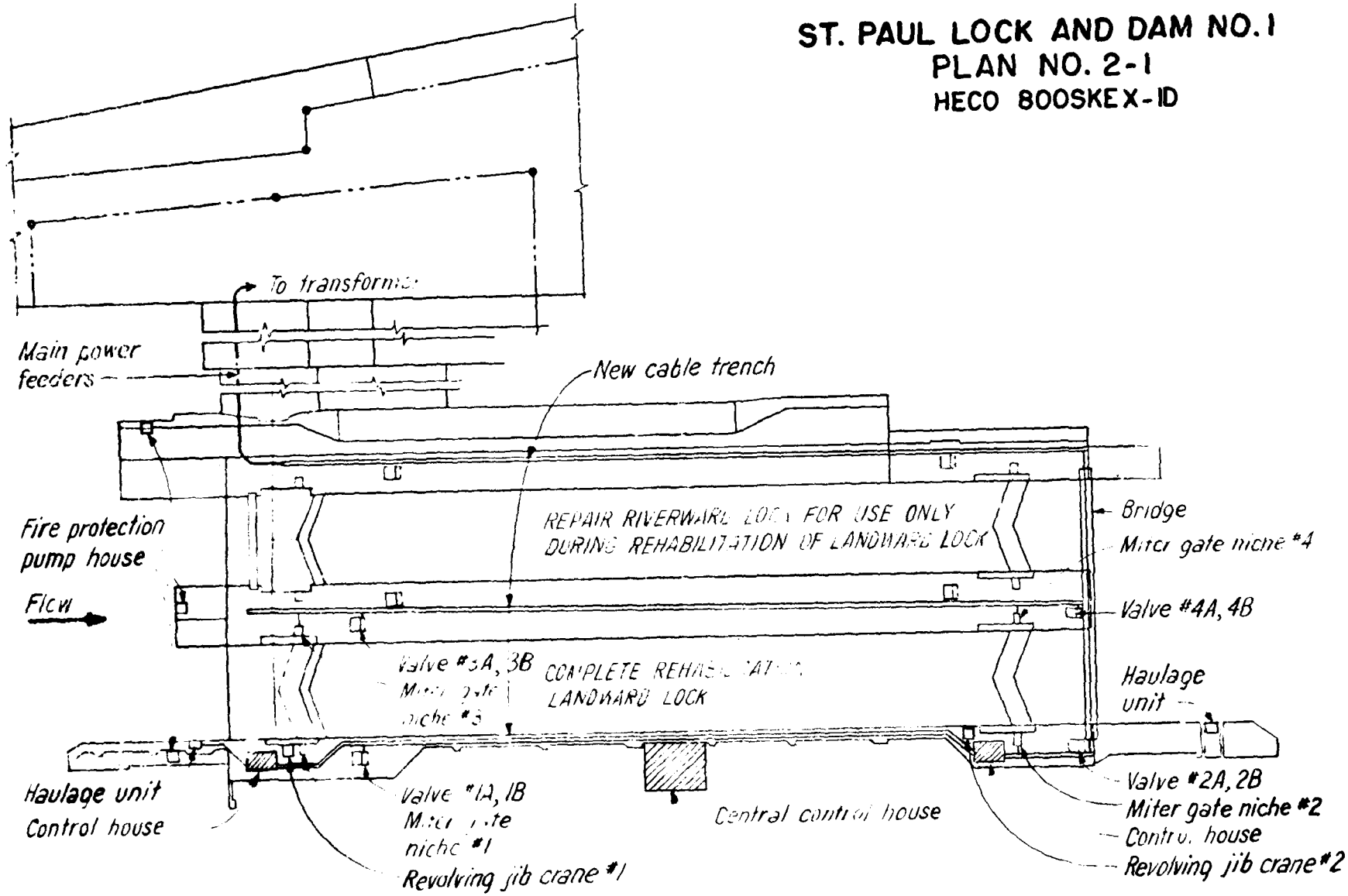
ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 9 of 9 Pages

Structure ELECTRICAL, PLAN #1-2 Estimated by AKK Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATES	LS	500.00	500 00
AD	WELDING	LS	2000.00	2 000 00
AE	STRUCTURAL STEEL	LS	2000.00	2 000 00
AF	PAINTING	LS	2,000.00	2 000 00
AG	TESTING AND INSPECTION	LS	5000.00	5 000 00
AH	CATHODIC TREATMENT OF MITERGATES	LS	24000.00	24 000 00
				35 500 00

ST. PAUL LOCK AND DAM NO. 1
PLAN NO. 2-1
HECO 800SKEX-1D



ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

REV. 9/75

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 1 of 9 Pages
GAD DAH

Structure ELECTRICAL PLAN #2-1 Estimated by AKK Checked by PRC

Item No.	ITEM	Quantity	Unit Price	Amount	
	VALVES & JIB CRANES			2 000	00
	FIRE PROTECTION			21 301	00
	PAGE 2			97 123	00 ✓
	PAGE 3			16 314	00 ✓
	PAGE 4			31 845	00 ✓
	PAGE 5			9 955	00 ✓
	PAGE 6			153 676	00 ✓
	PAGE 7			3 168	00 ✓
	PAGE 8			69 564	00 ✓
	PAGE 9			35 500	00 ✓
1	TOTAL (LANDWARD LOCK)			440 444	00
2	TOTAL (REPAIR RIVERWARD LOCK FOR USE ONLY DURING REHABILITATION OF LANDWARD LOCK)			25 000	00
3	REMOVAL OF EXISTING INSTALLED			3 000	00
	TOTAL 1, 2 AND 3			468 444	00
	OVERHEAD AND PROFIT 25%			117 111	00
	SUB-TOTAL			585 555	00
	CONTINGENCY 10%			58 555	00
	GRAND TOTAL		$	644 110	00
	USE			645 000	00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 2 of 9 Pages

Structure ELECTRICAL PLAN # 2-1 Estimated by AKK Checked by CRE

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9,200.00	9200 00
B	MOTOR CONTROL CENTER (CC5)	1	8660.00	8660 00
C	MOTOR CONTROL CENTER (CC1) WITH UNIT HEATER	1	17,300.00	17300 00
D	MOTOR CONTROL CENTER (CC2) WITH UNIT HEATER	1	20,200.00	20200 00
E	LIGHTING PANEL (DPB1)	1	725.00	725 00
F	LIGHTING PANEL (DPB2)	1	740.00	740 00
G	LIGHTING PANEL (DPB3)	1	610.00	610 00
H	LIGHTING PANEL (DPB4)	1	870.00	870 00
I	LIGHTING PANEL (DPB5)	1	820.00	820 00
J	TRANSFORMER			
J1	400 AMPS ACBS 3 POLE, 480	1	1,300.00	1300 00
J2	LIGHTING TRANSFORMER 15KVA	5	690.00	3450 00
J3	LIGHTING TRANSFORMER 3KVA	3	216.00	648 00
K	UPSTREAM CONTROL DESK (CD1)	1	15,500.00	15500 00
L	DOWNSTREAM CONTROL DESK (CD2)	1	15,500.00	15500 00
M	TRAFFIC PANEL	1	1600.00	1600 00
				97123 00

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

..oject ST. PAUL LOCK AND DAM #1 Date 12/74 Page 3 of 9 Pages

Structure ELECTRICAL PLAN #2-1 Estimated by AKK Checked by CRE

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL (LMCP)	1	5.950.00	5 950 00
O	HAULAGE UNIT	2	1,200.00	2 400 00
P	REMOTE CONTACTOR			
1P	NEMA SIZE 0, 2 POLE IN NEMA 4 ENCL.	4	140.00	560 00
Q	DISCONNECT PLUGS AND RECEPTACLE			
1Q	200AMPS 600V 3W 3P	1	420.00	420 00
2Q	100AMPS, 600V 3W 3P	6	240.00	1440 00
3Q	60AMPS 600V 3W 3P w. Pilot Plug	3	80.00	240 00
4Q	60AMPS 600V 2W 2P	5	144.00	720 00
5Q	30 AMPS 600V 3W 3P	17	84.00	1428 00
6Q				
7Q	20AMPS 600V 2W 2P	5	80.00	400 00
8Q	15 AMPS 125V 3W 3P	5	36.00	180 00
9Q	15 AMPS 125V 3W 2P	13	32.00	416 00
10Q	15 AMPS 125V 3W 2P	20	30.00	600 00
11Q	15 AMPS 125V 3W 2P DUPLEX	36	30.00	1080 00
12Q	15 AMPS 125V 3W 2P DUPLEX WEATHER PROOF BOX	16	30.00	480 00
				16514 00 ✓

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 4 of 9 Pages

Structure ELECTRICAL PLAN #2-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCHES			
1R	15A, 125V SPST	30	30.00	900 00
2R	15A, 125V SPST IN WEATHER PROOF BOX	20	35.00	700 00
3R	TRANSFER SWITCH IN NEMA 4 ENCL	17	100.00	1 700 00
S	MISCELLANEOUS ITEMS			
1S	WATER LEVEL TRANSMITTER	2	1,700.00	3 400 00
2S	BELL & HORN			
	9" 8-10V INDOOR BELL	1	20 00	20 00
	10" 115V OUTDOOR	1	85.00	85 00
	TWO WAY HORN	1	105 00	105 00
	HORN 125VDC HOOD	1	115.00	115 00
T	LIGHTING			
	POLE LIGHTING			
	TYPE A	14	[illegible]	11 760 00
	TYPE B	[illegible]	[illegible]	7 560 00
	TYPE D	1	[illegible]	1 400 00
	TYPE E	1	1400.00	1 400 00
	TYPE F	1	1400.00	1 400 00
	TYPE G	1	1300.00	1 300 00
				31 845 00 ✓

ESTIMATE HARZA ENGINEERING COMPANY
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Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 5 of 9 Pages

Structure ELECTRICAL PLAN #2-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
T	LIGHTING (CONT.)			
	TYPE H	2	1150.00	2300 00
	FLUORESCENT AND INCANDESCENT FIXTURE			
	TYPE A	8	113.00	904 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1482 00
	TYPE D	10	35.00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	6	40.00	240 00
	TYPE H	4	35.00	140 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE HINDS VOA 2857	2	50.00	100 00
	CROUSE HINDS WEATHER RESISTANT	16	40.00	640 00
	CROUSE HINDS WEATHER RESISTANT	4	40.00	160 00
	FLOOD LIGHT 150W [illegible]	16	70.00	1120 00
	FLOATING MOORING BITT LIGHT	3	210.00	630 00
	EMERGENCY LIGHT UNIT	3	275.00	825 00
	--AMP--			
	40W F.L.U.	62	1.70	105 40
	150W INCAND	58	1.00	58 00
	100W INCAND	60	0.70	42 00
	60W INCAND	30	0.62	18 60
				9953 00

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

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Structure ELECTRICAL, PLAN # 2-1 Estimated by AKK Checked by CPP

Item No.	ITEM	Quantity	Unit Price	Amount
V	JUNCTION BOXES			
IV	JBG1,2,3,4 ; JBV1,2,3,4 ; JB3,4 NEMA 4 ENCL. WITH TB	10	425.00	4 250 00
2V	JB 1,2 NEMA 1 ENCL WITH TB	2	50.00	100 00
3V	OTHER BOXES	LS	1000.00	1 000 00
W	CABLE AND WIRES			
	1/c - 500 MCM	13,500 FT	4.10	55 350 00
	1/c - 4/0	1,000 "	4.23	4 230 00
	1/c - 1/0 AWG	1,760 "	1.60	2 720 00
	1/c - 1 AWG	1,200 "	1.67	2 006 00
	1/c - 4 AWG	1,250 "	6.70	8 625 00
	1/c - 6 AWG	1,000 "	5.50	5 500 00
	1/c - 8 AWG	5,000 "	0.32	1 600 00
	1/c - 10 AWG	3,000 "	0.25	750 00
	1/c - 12 AWG	6,000 "	0.25	1 520 00
	1/c - 14 AWG	1,200 "	0.13	156 00
	2/c - 10	2,500 "	0.58	1 450 00
	3/c - 10	1,200 "	0.61	1 458 00
	4/c - 10	1,200 "	1.80	2 160 00
	2/c - 12	6,000 "	0.42	2 520 00
	3/c - 12	2,300 "	0.70	1 610 00
	4/c - 12	200 "	0.83	166 00
	6/c - 12	4,600 "	1.63	7 380 00
	9/c - 12	1,000 "	1.80	16 200 00
	12/c - 12	1,500 "	2.17	32 550 00
	24/c - 12	1,000 "	3.75	3 375 00
				193 676 00

ESTIMATE HARZA ENGINEERING COMPANY CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 7 of 9 Pages

Structure ELECTRICAL PLAN #2-1 Estimated by AKK Checked by CPP

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLES AND WIRES (CONT.)			
	2/c - 14 AWG	1,200 FT	0.31	372 00
	3/c - 14	100 "	0.46	46 00
	FLEXIBLE CABLE			
	2/c - 6 AWG	100 "	2.60	260 00
	3/c - 6 AWG	100 "	3.50	350 00
	4/c - 6 AWG	100 "	4.20	420 00
	2/c - 8 AWG	100 "	2.20	220 00
	3/c - 8 AWG	100 "	2.60	260 00
	2/c - 12 AWG	600 "	1.65	990 00
	3/c - 12 AWG	200 "	1.00	200 00
				3168 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 8 of 9 Pages

Structure ELECTRICAL PLAN # 2-1 Estimated by AKK Checked by CPO

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	"	3200 FT	8.65	27 680 00
	"	2200 "	5.27	11 594 00
	"	1000 "	3.40	3 400 00
	"	500 "	2.65	1 325 00
	"	1000 "	2.14	2 140 00
	"	2300 "	1.74	4 300 00
	ALLOWANCE FOR CONCRETE CUTTING	1		5 000 00
	FLEXIBLE CONDUIT			
	"	50 "		430 00
	"	100 "		700 00
	"	200 "		380 00
	"	100 "		325 00
Y	CONNECTIONS			
1Y	MOTOR	16		800 00
2Y	L.S.	8	300.00	2 400 00
3Y	L.S.	4	50.00	200 00
Z	[illegible]			
1AA	EXPANSION JOINT			
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	1.500 FT	3.60	5 400 00
	4/0 AWG	500 "	2.10	1 050 00
	4 AWG	2.200 "	0.70	1 540 00
2AB	GRD PLATE	6	150.00	900 00
				69 564 00

ESTIMATE **HARZA ENGINEERING COMPANY**
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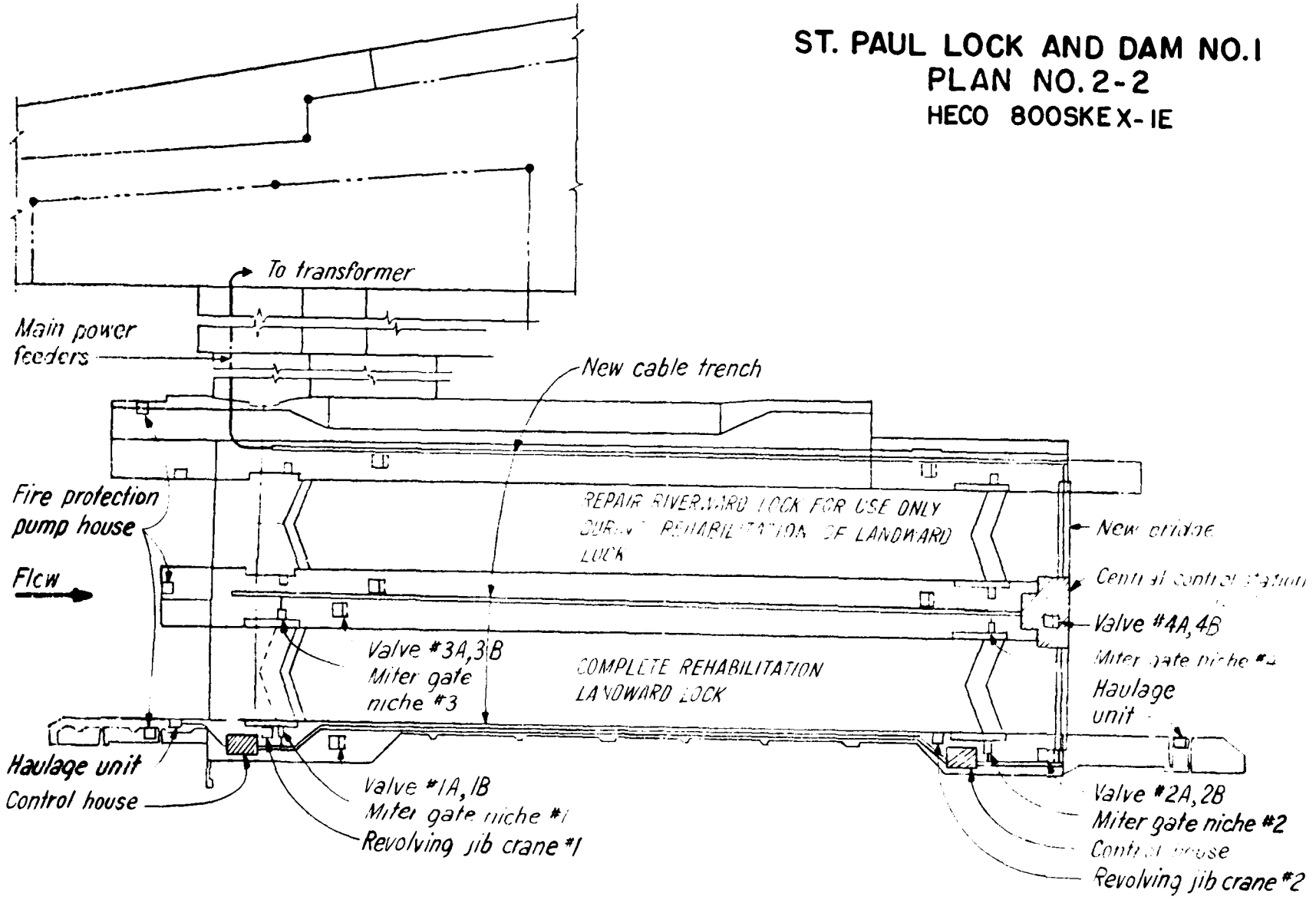
Structure ELECTRICAL PLAN # 2-1 Estimated by AKK Checked by CPO

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATES	LS	500.00	500 00
AD	WELDING	LS	2,000.00	2 000 00
AE	STRUCTURAL STEEL	LS	2,000.00	2 000 00
AF	PAINTING	LS	2,000.00	2 000 00
AG	TESTING AND INSPECTION	LS	3,000.00	5 000 00
AH	CAT DOL [illegible]	--	24,000.00	24 000 00
				35 500 00 ✓

ST. PAUL LOCK AND DAM NO.1
PLAN NO. 2-2
HECO 800SKEX-IE



ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

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Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 1 of 9 Pages

Structure ELECTRICAL PLAN #2-2 Estimated by GAD AKK Checked by DAH CRC

Item No.	ITEM	Quantity	Unit Price	Amount	
	VALVES & JIB CRANES			2 000 00	
	FIRE PROTECTION			21 301 00	
	PAGE 2			97 123 00	✓
	PAGE 3			16 314 00	✓
	PAGE 4			31 845 00	✓
	PAGE 5			9 953 00	✓
	PAGE 6			157 871 00	✓
	PAGE 7			3 168 00	✓
	PAGE 8			66 104 00	✓
	PAGE 9			35 500 00	
1	TOTAL (LANDWARD LOCK)			441 179 00	
2	TOTAL (RIVERWARD LOCK)			25 000 00	
	(REPAIR RIVERWARD LOCK FOR USE				
	DURING REHABILITATION OF				
	LANDWARD LOCK)				
3	REMOVAL OF EXISTING INSTALLATION			3 000 00	
	TOTAL 1, 2 AND 3			469 179 00	
	OVERHEAD AND PROFIT 25%			117 294 00	
	SUB-TOTAL			586 473 00	
	CONTINGENCY 10%			58 647 00	
	GRAND TOTAL		$	645 120 00	
	USE			650 000 00	

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 2 of 9 Pages

Structure ELECTRICAL PLAN # 2-2 Estimated by AKK Checked by CRR

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9200.00	9 200 00
B	MOTOR CONTROL CENTER (CCS)	1	8660.00	8 660 00
C	MOTOR CONTROL CENTER (CC1) WITH UNIT HEATER	1	17.300.00	17 300 00
D	MOTOR CONTROL CENTER (CCS) WITH UNIT HEATER	1	20.200.00	20 200 00
E	LIGHTING PANEL (DPB1)	1	725.00	725 00
F	LIGHTING PANEL (DPB2)	1	740.00	740 00
G	LIGHTING PANEL (DPB3)	1	610.00	610 00
H	LIGHTING PANEL (DPB4)	1	870.00	870 00
I	LIGHTING PANEL (DPB5)	1	820.00	820 00
J	TRANSFORMER			
J1	400AMPS ACBS 3POLE 480V	1	1.300.00	1 300 00
J2	LIGHTING TRANSFORMER 15KVA	5	690.00	3 450 00
J3	LIGHTING TRANSFORMER 3KVA	3	216.00	648 00
K	UPSTREAM CONTROL DESK (CD1)	1	15.500.00	15 500 00
L	DOWNSTREAM CONTROL DESK (CD2)	1	15.500.00	15 500 00
M	TRAFFIC PANEL	1	1.600.00	1 600 00
				97 123 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 3 of 9 Pages

Structure ELECTRICAL, PLAN #2-2 Estimated by AKK Checked by CRE

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL (LMCP)	1	5,950.00	5,950.00
O	HAULAGE UNIT	2	1,200.00	2,400.00
P	REMOTE CONTACTOR			
1P	NEMA SIZE 0, 2 POLE IN NEMA 4 ENCLOSURE	4	140.00	560.00
Q	DISCONNECT PLUGS AND RECEPTACLES			
1Q	200 AMPS, 600V, 3W, 3P	1	420.00	420.00
2Q	100 AMPS, 600V, 3W, 3P	6	240.00	1,440.00
3Q	60 AMPS, 600V, 3W, 3P WITHOUT PLUG	3	80.00	240.00
4Q	60 AMPS, 600V, 2W, 2P	5	144.00	720.00
5Q	30 AMPS, 600V, 3W, 3P	17	84.00	1,428.00
6Q				
7Q	20 AMPS, 600V, 2W, 2P	5	[illegible]	400.00
8Q	15 AMPS, 125V, 3W, 3P	5	36.00	180.00
9Q	15 AMPS, 125V, 3W, 2P	13	32.00	416.00
10Q	15 AMPS, 125V, 3W, 2P	20	[illegible]	600.00
11Q	15 AMPS, 125V, 3W, 2P DUPLEX	36	30.00	1,080.00
12Q	15 AMPS, 125V, 3W, 2P DUPLEX WITH WEATHERPROOF BOX	16	30.00	480.00
				16,314.00 ✓

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM # 1 Date 12/74 Page 4 of 9 Pages

Structure ELECTRICAL PLAN # 2-2 Estimated by AKK Checked by CBO

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCHES			
1R	15A 125V SPST	30	30.00	900 00
2R	15A 125V SPST WEATHERPROOF BOX	20	35.00	700 00
3R	TRANSFER SWITCH IN NEMA 4 ENCL	17	100.00	1700 00
S	MISCELLANEOUS ITEMS			
1S	WATER LEVEL TRANSMITTER	2	1,700.00	3400 00
2S	BELL AND HORN			
	4" 8-10 VOLTS INDOOR	1	20.00	20 00
	10" 115 VOLTS OUTDOOR	1	[illegible]	85 00
	TWO WAY HORN	1	[illegible]	105 00
	HORN 125 V DC 110DB	1	[illegible]	115 00
T	LIGHTING			
	POLE LIGHTING			
	TYPE A	14	[illegible]	11760 00
	TYPE B	2	[illegible]	7560 00
	TYPE D	1	[illegible]	1400 00
	TYPE E	1	[illegible]	1400 00
	TYPE F	1	1400.00	1400 00
	TYPE G	1	1300.00	1300 00
				31 845 00 ✓

ESTIMATE

HARZA ENGINEERING COMPANY
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Structure ELECTRICAL PLAN # 2-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
T	LIGHTING (CONT)			
	TYPE H	2.	1150.00	2300 00
	FLUORESCENT AND INCANDESCENT FIXTURE			
	TYPE A	8	113.00	904 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1482 00
	TYPE D	10	35 00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	6	40.00	240 00
	TYPE H	4	35.00	140 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE HIND VDA 2857	2	50.00	100 00
	CROUSE HIND WEATHER RESISTANT	16	40.00	640 00
	CROUSE HIND WEATHER RESISTANT	4	40.00	160 00
	FLOOD LIGHT 150W REVERLCAT	16	70.00	1120 00
	FLOR VC HOODED BITT LIGHTS	3	210.00	630 00
	EMERGENCY UNIT	3	275 00	825 00
	LAMPS			
	40W FLU	60	1.70	105 40
	150W INCAND	58	1.00	58 00
	100W INCAND	60	0.70	42 00
	60W INCAND	30	0.62	18 60
				9955 00

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 6 of 9 Pages

Structure ELECTRICAL, PLAN #2-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
V	JUNCTION BOXES			
IV	JBG1,2,3,4 JBV1,2,3,4 JB3,4 NEMA 4 ENCLOSURE WITH TB	10	425.00	4250 00
2V	JB12 NEMA 1 ENCLOSURE WITH TB	2	50.00	100 00
3V	OTHER BOXES	LS	1000.00	1000 00
W	CABLES AND WIRES			
	1/c 500 MCM	12,000 FT	4.10	49 200 00
	1/c - 4/0 AWG	3,100 "	2.35	7 285 00
	1/c - 1/0 AWG	1700 "	1.60	2 720 00
	1/c - 1	1700 "	1.18	2 006 00
	1/c - 4	9500 "	0.75	7 125 00
	1/c 6	13500 "	0.55	7 425 00
	1/c 8	12,500 "	0.32	4 000 00
	1/c 10	3,000 "	0.25	750 00
	1/c 12	8,000 "	0.19	1520 00
	1/c 14	1,200 "	0.13	156 00
	2/c 10	2,500 "	0.58	1450 00
	3/c 10	1,800 "	0.81	1458 00
	4/c 10	1,000 "	1.20	1200 00
	2/c 12	6,000 "	0.42	2 520 00
	3/c 12	2,300 "	2.70	1610 00
	4/c 12	200 "	0.83	160 00
	6/c 12	6,000 "	1.23	7 380 00
	9/c 12	9,000 "	1.80	16 200 00
	12/c 12	17,500 "	2.17	37 975 00
	24/c 12	100 "	3.75	375 00
				157 871 00

ESTIMATE

HARZA ENGINEERING COMPANY
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Structure ELECTRICAL PLAN #2-2 Estimated by AKK Checked by PBC

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLE AND WIRES (CONT)			
	2/C - 14 AWG	1200 FT	0.31	372 00
	3/C - 14 AWG	100 "	0.46	46 00
	FLEXIBLE CABLE			
	2/C - 6	100 "	2.60	260 00
	3/C 6	100 "	3.50	350 00
	4/C 6	100 "	4.20	420 00
	2/C - 8	100 "	2.20	220 00
	3/C - 8	100 "	2.60	260 00
	2/C - 12	800 "	1.20	960 00
	3/C - 12	200 "	1.40	280 00
				3168 00 ✓

ESTIMATE

HARZA ENGINEERING COMPANY
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Structure ELECTRICAL, PLAN # 2-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	3"	2,800 FT	8.65	24 220 00
	2"	2,200 "	5.27	11 594 00
	1½"	1,000 "	3.40	3 400 00
	1¼"	500 "	2.65	1 325 00
	1"	1,000 "	2.14	2 140 00
	3/4"	2,500 "	1.72	4 300 00
	ALLOWANCE FOR CONCRETE CUTTING	1	-	5 000 00
	FLEXIBLE CONDUITS			
	2"	200 "	2.00	430 00
	1½"	100 "	1.00	700 00
	1"	100 "	3.80	380 00
	3/4"	100 "	[illegible]	325 00
Y	CONNECTIONS			
1Y	MOTOR CONNECTION	16	[illegible]	800 00
2Y	LIMIT SWITCH	8	300.00	2 400 00
3Y	LIMIT SWITCH	4	50.00	200 00
Z	TRENCH AND HANDHOLE	-		- -
	TRANSFORMER FOUNDATION			
AA	EXPANSION JOINT	-	-	- -
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	1,500 FT.	3.60	5 400 00
	4/0 AWG	500 "	2.10	1 050 00
	4 AWG	2,200 "	0.70	1 540 00
2AB	GRD PLATE	6	150.00	900 00
				66 104 00 ✓

ESTIMATE

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CHICAGO, ILLINOIS

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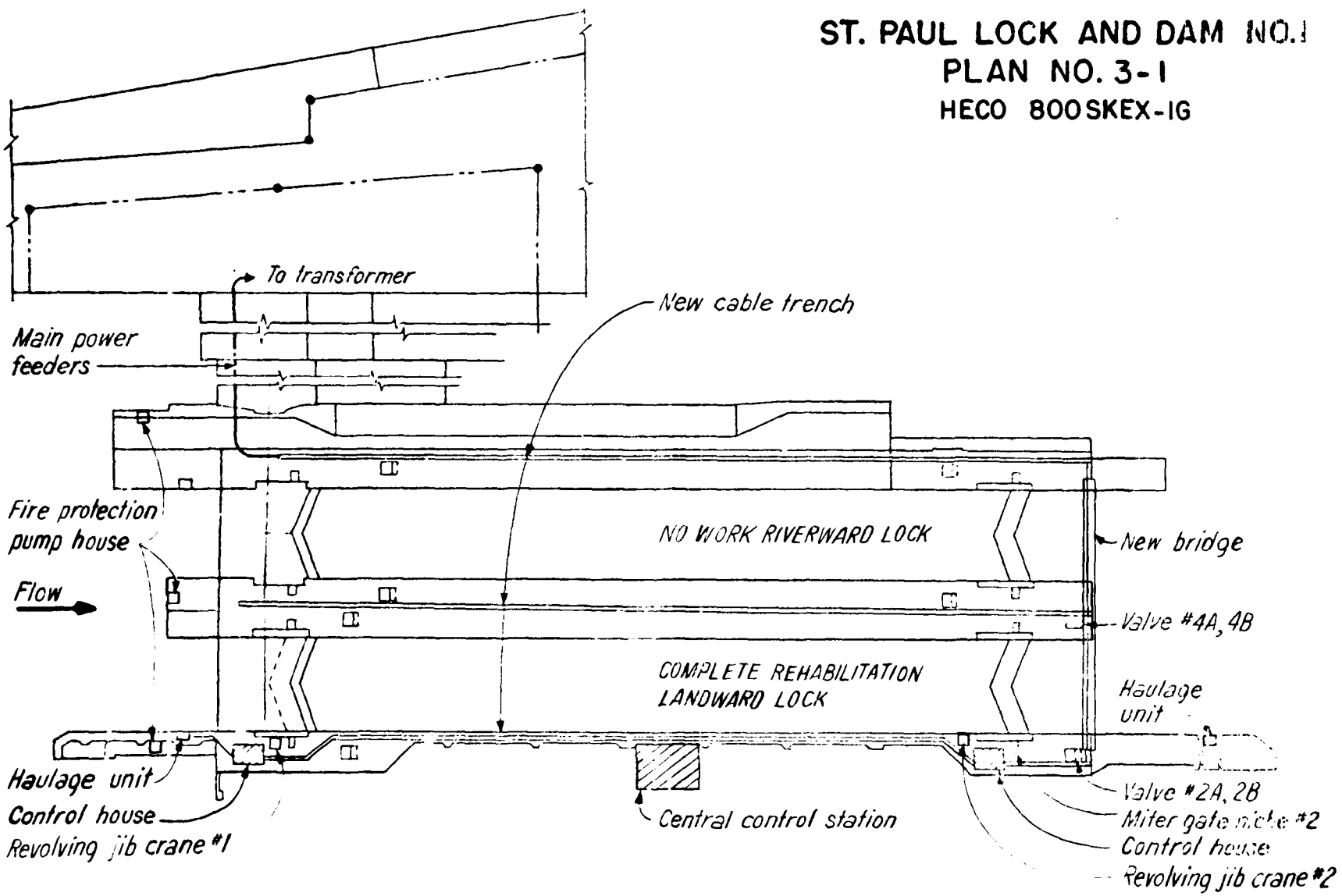
Structure ELECTRICAL, PLAN #2-2 Estimated by AKK Checked by CRL

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATES	LS	500.00	500 00
AD	WELDING	LS	2,000.00	2000 00
AE	STRUCTURAL STEEL	LS	2,000.00	2 000 00
AI	PAINTING	LS	2,000.00	2 000 00
AJ	TESTING	LS	5,000.00	5 000 00
AH	CATHODIC TREATMENT OF MITERGATES	LS	24000.00	24 000 00
				35 500 00

ST. PAUL LOCK AND DAM NO.1
PLAN NO. 3-1
HECO 800SKEX-1G



ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 1 of 9 Pages

Structure ELECTRICAL PLAN # 3-1 Estimated by GAD AKK Checked by DAH ERC

Item No.	ITEM	Quantity	Unit Price	Amount
	VALVES & JIB CRANES			2 000 00
	FIRE PROTECTION			21 301 00
	PAGE 2			97 123 00
	PAGE 3			16 314 00
	PAGE 4			31 845 00
	PAGE 5			9 953 00
	PAGE 6			153 676 00
	PAGE 7			3 168 00
	PAGE 8			69 564 00
	PAGE 9			35 500 00
1	TOTAL (LANDWARD LOCK)			440 444 00
2	TOTAL (RIVERWARD LOCK)	NO WORK		
3	REMOVAL OF EXISTING INSTALLATION			3 000 00
	TOTAL 1, 2 AND 3			443 444 00
	OVERHEAD AND PROFIT 25%			110 861 00
	SUB-TOTAL			554 305 00
	CONTINGENCY 10%			55 430 00
	GRAND TOTAL		$	609 735 00
	USE			610 000 00

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 2 of 9 Pages

Structure ELECTRICAL, PLAN # 3-1 Estimated by AKK Checked by CPR

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9,200.00	9 200 00
B	MOTOR CONTROL CENTER (CC5)	1	8,660.00	8660 00
C	MOTOR CONTROL CENTER (CC1) WITH UNIT HEATER	1	17,300.00	17 300 00
D	MOTOR CONTROL CENTER (CC2) WITH UNIT HEATER	1	20,200.00	20 200 00
E	LIGHTING PANEL (DPB1)	1	725.00	725 00
F	LIGHTING PANEL (DPB2)		740.00	740 00
G	LIGHTING PANEL (DPB3)	1	610.00	610 00
H	LIGHTING PANEL (DPB4)		870.00	870 00
I	LIGHTING PANEL (DPB5)	1	820.00	820 00
J	TRANSFORMER			
J1	400AMP ACB 3 POLE, 480V	1	1300.00	1 300 00
J2	LIGHTING TRANSFORMER 15KVA	5	690.00	3 450 00
J3	LIGHTING TRANSFORMER 3KVA	3	216.00	648 00
K	UPSTREAM CONTROL DESK (CD1)	1	15,500.00	15 500 00
L	DOWNSTREAM CONTROL DESK (CD2)	1	15,500.00	15 500 00
M	TRAFFIC PANEL	1	1,600.00	1 600 00
				97 123 00 ✓

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLANT 3-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL	1	5,950.00	5 950 00
O	HAULAGE UNIT	2	1,200.00	2 400 00
P	REMOTE CONTACTORS			
P	NEMA SIZE 0 2 POLE IN NEMA 4 ENCLOSURE	4	140.00	560 00
Q	DISCONNECT PLUGS AND RECEPTACLE			
10	200 AMPS 600V 3W 3P	1	420.00	420 00
28	100 AMP. 600V 3W 3P	6	[illegible]	1 440 00
34	[illegible] AMP 600V 3W 3P WITHOUT PLUG	3	[illegible]	240 00
[illegible]	[illegible] AMP 600 3W 3P	5	[illegible]	720 00
[illegible]	[illegible] AMP 600 [illegible] 3P	17	[illegible]	1 428 00
65			—	—
16	[illegible] 600V [illegible]	5	[illegible]	400 00
[illegible]	[illegible] 600V 3W 3P	5	[illegible]	180 00
64	15 AMP [illegible] 3P	13	32.00	416 00
[illegible]	[illegible] 3W 3P	20	[illegible]	600 00
116	15 AMP 125 V 3W 2P DUPLEX	36	[illegible]	1 080 00
[illegible]	AMPS 125 V 3W 2P DUPLEX [illegible]	16	30.00	480 00
	[illegible] APPROX 50%			
				16 314 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 4 of 9 Pages

Structure ELECTRICAL PLAN #3-1 Estimated by AKK Checked by CRE

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCHES			
1R	15A, 125V SPST	30	30.00	900 00
2R	15A 125V SPST IN WEATHERPROOF BOX	20	35.00	700 00
3K	TRANSFER SWITCH IN NEMA 4 ENCL	17	100.00	1700 00
S	MISCELLANEOUS ITEMS			
1S	WATER LEVEL TRANSMITTER	2	1,700.00	3400 00
2S	BELL AND HORN			
	4" 8 10 VOLT INDOOR	1	20.00	2000
	10" 115 VOLT OUTDOOR	1	85.00	8500
	TWO WAY HORN	1	105.00	10500
	HORN 125 VDC, 1100B	1	115.00	11500
T	LIGHTING			
	POLE LIGHTS			
	TYPE A	14	840.00	11760 00
	TYPE B	9	840.00	7560 00
	TYPE D	1	1400.00	1400 00
	TYPE E	1	1400.00	1400 00
	TYPE F	1	1400.00	1400 00
	TYPE A	1	1,300.00	1300 00
				51 845 00

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 5 of 9 Pages

Structure ELECTRICAL PLANT 3-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
T	LIGHTING (CONT.)			
	TYPE H	2	1150.00	2300 00
	FLUORESCENT AND INCANDESCENT FIXTURE			
	TYPE A	8	113.00	904 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1482 00
	TYPE D	10	35.00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	6	40.00	240 00
	TYPE H	4	35.00	140 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE HIND VDA 2857	2	50.00	100 00
	CROUSE HIND WEATHER RESISTANT	16	40.00	640 00
	CROUSE HIND WEATHER RESISTANT	4	40.00	160 00
	FLOOD LIGHT 150W REFLECTOR	16	10.00	1120 00
	FLOATING MOORING BITT LIGHT	3	210.00	630 00
	EMERGENCY LIGHT UNIT	3	275.00	825 00
	LAMPS			
	40W FLU	62	.70	105 40
	150W INCAND	58	1.00	58 00
	100W INCAND	66	0.70	42 00
	60W INCAND	30	0.62	18 60
				19 953 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 6 of 9 Pages

Structure ELECTRICAL PLANT 3-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
V	JUNCTION BOXES			
IV	JBG 1,2,3,4 ; JBV 1,2,3,4 ; JB 3,4 NEMA 4 ENCLOSURE WITH TB	10	425.00	4 25000
2V	JB 1,2 NEMA 1 ENCLOSURE WITH TB	2	50.00	100 00
3V	OTHER BOXES	LS	1000.00	1,000 00
W	CABLE AND WIRE			
	1/c 500 MCM	13,500 FT	4.10	55 35000
	1/c - 4/0 AWG	1,800 "	2.35	4 23000
	1/c - 1/0 AWG	1,700 "	1.60	2 72000
	1/c 1	1700 "	1.18	2 00600
	1/c - 4	11,500 "	0.75	8 62500
	1/c - 6	10,000 "	0.55	5 50000
	1/c - 8	5,000 "	0.32	1 60000
	1/c - 10	3,000 "	0.25	75000
	1/c 12	8,000 "	0.19	1 52000
	1/c 14	1,200 "	0.13	156 00
	2/c - 10	2,500 "	0.58	1 45000
	3/c 10	1,800 "	0.81	1 45800
	4/c - 10	1,800 "	1.20	2 16000
	2/c 12	6,000 "	0.42	2 52000
	3/c 12	2,300 "	0.70	1 61000
	4/c - 12	200 "	0.83	166 00
	6/c - 12	6,000 "	1.23	7 38000
	7/c 12	9,000 "	1.80	16 20000
	12/c - 12	15,000 "	2.17	32 55000
	24/c 12	100 "	3.75	375 00

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

Object ST PAUL LOCK AND DAM #1 Date 12/74 Page 7 of 9 Pages

Structure ELECTRICAL PLAN #1 3-1 Estimated by AICIC Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLES AND WIRES (CONT)			
	2/C - 14 AWG	1200 FT	0.31	372 00
	3/C 14	100 "	0.46	46 00
	FLEXIBLE CABLE			
	2/C - 6 AWG	100 "	2.60	260 00
	3/C 6	100 "	3.50	350 00
	4/C 6	100 "	4.20	420 00
	4/C 8	100 "	2.20	220 00
	3/C 8	100 "	2.60	260 00
	4/C 12	800 "	1.20	960 00
	3/C 12	200 "	1.40	280 00
				3,168 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 8 of 9 Pages

Structure ELECTRICAL PLAN #3-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	3"	3,200 FT	8.65	27 680 00
	2"	2,200 "	5.27	11 594 00
	1½"	1,000 "	3.40	3 400 00
	1¼"	500 "	2.65	1 325 00
	1"	1,000 "	2.14	2 140 00
	3/4"	2,500 "	1.72	4 300 00
	ALLOWANCE FOR CONCRETE CUTTING	1	—	5 000 00
	FLEXIBLE CONDUITS			
	2"	50 "	8.60	430 00
	1½"	100 "	7.00	700 00
	1"	100 "	3.80	380 00
	3/4"	100 "	3.25	325 00
Y	CONNECTIONS			
1Y	MOTOR CONNECTIONS	16	50.00	800 00
2Y	LIMIT SWITCH	8	300.00	2 400 00
3Y	LIMIT SWITCH	4	50.00	200 00
Z	TRENCH AND HANDHOLES	—	—	—
AA	EXPANSION JOINTS	—		
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	1,500 FT	3.60	5 400 00
	4/0 AWG	500 "	2.10	1 050 00
	4 AWG	2,200 "	0.70	1 540 00
2AB	GRD PLATE	6	150.00	900 00
				69 564 00

ESTIMATE

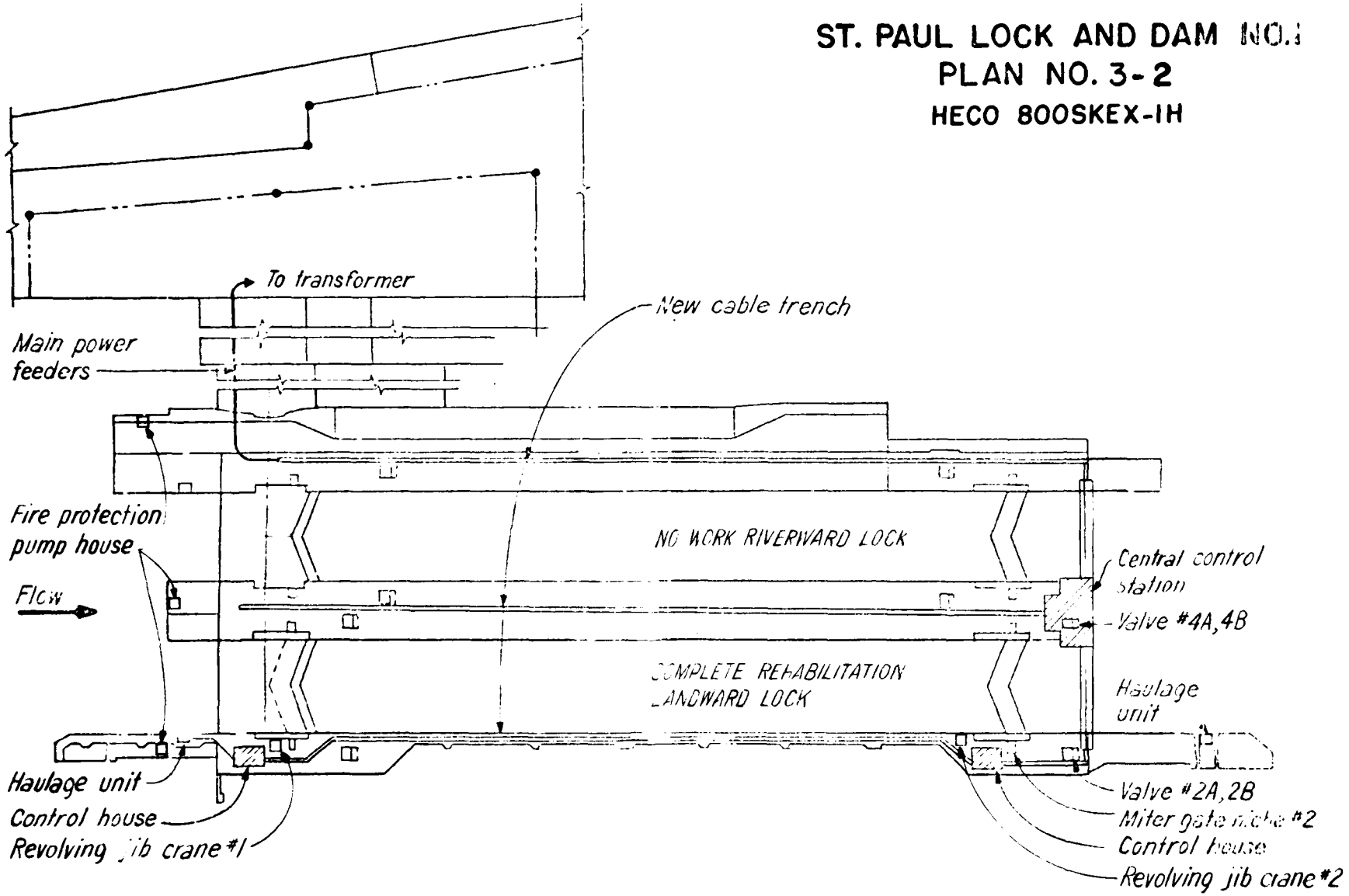
HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 9 of 9 Pages

Structure ELECTRICAL PLAN #3-1 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATE	LS	500.00	500 00
AD	WELDING	LS	2000.00	2 000 00
AE	STRUCTURAL STEEL	LS	2000.00	2 000 00
AF	PAINTING	LS	2000.00	2 000 00
AG	TESTING AND INSPECTION	LS	5000.00	5 000 00
AH	ASSEMBLY ERECTION OF MISC.	LS	24000.00	24 000 00
				35 500 00

ST. PAUL LOCK AND DAM NO.1
PLAN NO. 3-2
HECO 800SKEX-1H



ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

REV. 9/75

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 1 of 9 Pages
GAD DAH

Structure ELECTRICAL PLAN # 3-2 Estimated by AKK Checked by CRO

Item No.	ITEM	Quantity	Unit Price	Amount	
	VALVES & JIB CRANES			2 000	00
	FIRE PROTECTION			21 301	00
	PAGE 2			97 123	00 ✓
	PAGE 3			16 314	00 ✓
	PAGE 4			31 845	00 ✓
	PAGE 5			9 953	00 ✓
	PAGE 6			157 871	00 ✓
	PAGE 7			3 168	00 ✓
	PAGE 8			66 104	00 ✓
	PAGE 9			35 500	00 ✓
1	TOTAL [illegible] LOCK			441 179	00
2	TOTAL (EMERGENCY LOCK)	NO WORK		—	—
3	REMOVAL OF EXISTING INSTALLATION			3 000	00
	TOTAL 1, 2 AND 3			444 179	00
	OVERHEAD AND PROFIT 25%			111 044	00
	SUB-TOTAL			555 223	00
	CONTINGENCY 10%			55 522	00
	GRAND TOTAL		$	610 745	00
	USE			615 000	00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 8 of 9 Pages

Structure ELECTRICAL PLAN #3-2 Estimated by AKK Checked by CRR

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9,200.00	9200 00
B	MOTOR CONTROL CENTER (CC5)	1	8,660.00	8660 00
C	MOTOR CONTROL CENTER (CC1) WITH UNIT HEATER	1	17,300.00	17300 00
D	MOTOR CONTROL CENTER (CC2) WITH UNIT HEATER	1	20,200.00	20200 00
E	LIGHTING PANEL (DPB1)	1	725.00	725 00
F	LIGHTING PANEL (DPB2)	1	740.00	740 00
G	LIGHTING PANEL (DPB3)	1	610.00	610 00
H	LIGHTING PANEL (DPB4)	1	870.00	870 00
I	LIGHTING PANEL (DPB5)	1	820.00	820 00
J	TRANSFORMER			
J1	400AMPS ACB, 3POLE, 480V	1	1,300.00	1300 00
J2	LIGHTING TRANSFORMER 15KVA	5	690.00	3450 00
J3	LIGHTING TRANSFORMER 3KVA	3	216.00	648 00
K	UPSTREAM CONTROL DESK (CD1)	1	15,500.00	15500 00
L	DOWNSTREAM CONTROL DESK (CD2)	1	15,500.00	15500 00
M	TRAFFIC PANEL	1	1,600.00	1600 00
				92 123 00

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 3 of 9 Pages

Structure ELECTRICAL PLAN # 3-2 Estimated by AKK Checked by ORC

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL (LMCP)	1	5.950.00	5 950 00
O	HAULAGE UNIT	2	1,200.00	2 400 00
P	REMOTE CONTACTOR			
1P	NEMA SIZE 0, 2 POLE IN NEMA 4 ENCLOSURE	4	140.00	560 00
Q	DISCONNECT, PLUGS AND RECEPTACLE			
1Q	200 AMPS, 600V, 3W, 3P	1	420.00	420 00
2Q	100 AMPS, 600V 3W, 3P	6	240 00	1440 00
3Q	60 AMPS 600V 3W, 3P WITHOUT PLUG	3	80.00	240 00
4Q	60 AMPS 600V 2W, 2P	5	144 00	720 00
5Q	30 AMPS, 600V 3W 3P	17	84.00	1428 00
6Q				
7Q	20 AMPS, 600V 2W, 2P	5	80.00	400 00
8Q	15 AMPS, 125V, 3W, 3P	5	36.00	180 00
9Q	15 AMPS, 125V 3W, 2P	13	32.00	416 00
10Q	15 AMPS, 125V 3W 2P	20	30.00	600 00
11Q	15 AMPS, 125V, 3W, 2P DUPLEX	36	30.00	1080 00
12Q	15 AMPS, 125V, 3W 2P DUPLEX WITH WEATHERPROOF BOX	16	30.00	480 00
				16514 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM # 1 Date 12/74 Page 4 of 9 Pages

Structure ELECTRICAL, PLAN # 3-2 Estimated by AKK Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCH			
1R	15A, 125V SPST	30	30.00	900 00
2R	15A, 125V SPST IN WEATHERPROOF BOX	20	35.00	700 00
3R	[illegible] SWITCH IN ALUM. ENCLOSURE	17	100 00	1700 00
S	MISCELLANEOUS ITEMS			
1S	WATER LEVEL TRANSMITTER	2	1700.00	3400 00
2S	BELL AND HORN			
	4" 8 10 VOLT INDOOR	1	20.00	2000
	10" 115 VOLT OUTDOOR	1	85.00	8500
	TWO WAY HORN	1	105.00	10500
	HORN 125V DC 110DB	1	115.00	11500
T	LIGHTING			
	POLE LIGHTING			
	TYPE A	14	840.00	11760 00
	TYPE B	9	840.00	7560 00
	TYPE D	1	1400.00	1400 00
	TYPE E	1	1400.00	1400 00
	TYPE F	1	[illegible]	1400 00
	TYPE G	1	[illegible]	1300 00
				31 845 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM # 1 Date 12/74 Page 5 of 9 Pages

Structure ELECTRICAL PLAN # 3-2 Estimated by AK-K Checked by CPP

Item No.	ITEM	Quantity	Unit Price	Amount
I	LIGHTING (UNIT)			
	TYPE H1	2	1150.00	2300 00
	FLUORESCENT AND INCANDESCENT FIXTURE			
	TYPE A	8	113.00	904 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1482 00
	TYPE D	10	35.00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	6	40.00	240 00
	TYPE H	4	35.00	140 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE HIND VOA 2857	2	50.00	100 00
	CROUSE HIND WEATHER RESISTANT	16	40.00	640 00
	CROUSE HIND WEATHER RESISTANT	4	40.00	160 00
	FLOOD LIGHT ISOLA REVERE	16	70.00	1120 00
	FLOATING MOORING BITT LIGHTS	3	210.00	630 00
	EMERGENCY UNIT	3	275.00	825 00
	LAMPS			
	40W FLU	62	1.70	105 40
	150W INCAND.	58	1.00	58 00
	100W INCAND.	60	0.70	42 00
	[illegible] INC.	30	0.62	18 60
				9953 00 ✓

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Subject ST PAUL LOCK AND DAM # 1 Date 12/74 Page 6 of 9 Pages

Structure ELECTRICAL, PLAN # 3-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
V	JUNCTION BOXES			
IV	JBG1,2,3,4 JBV1,2,3,4 · JB3,4 NEMA 4 ENCLOSURE WITH TB	10	425.00	4250 00
2V	JB1,2 NEMA 1 ENCLOSURE WITH TB	2	50.00	100 00
3V	OTHER BOXES	LS	1000.00	1000 00
W	CABLE AND WIRES			
	1/c · 500 MCM	12,000 FT	4.10	49 200 00
	1/c - 4/0 AWG	3,100 "	2.35	7 285 00
	1/c - 1/0 AWG	1,700 "	1.60	2 720 00
	1/c - 1	1,700 "	1.18	2 006 00
	1/c - 4	9,500 "	0.75	7 125 00
	1/c - 6	13,500 "	0.55	7 425 00
	1/c - 8	12,500 "	0.32	4 000 00
	1/c - 10	3,000 "	0.25	750 00
	1/c · 12	8,000 "	0.19	1 520 00
	1/c · 14	1200 "	0.13	156 00
	2/c · 10	2,500 "	0.58	1 450 00
	3/c · 10	1,800 "	0.81	1 458 00
	4/c · 10	1,000 "	1.20	1 200 00
	2/c · 12	6,000 "	0.42	2 520 00
	3/c - 12	2,300 "	0.70	1 610 00
	4/c · 12	200 "	0.83	166 00
	6/c · 12	6,000 "	1.23	7 380 00
	9/c · 12	9,000 "	1.80	16 200 00
	12/c · 12	17,500 "	2.17	37 975 00
	24/c · 12	100 "	3.75	375 00
				157 871 00 ✓

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 7 of 9 Pages

Structure ELECTRICAL, PLAN # 3-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLES AND WIRES (CONT)			
	2/C - 14 AWG	1200 FT	0.31	372 00
	3/C 14	100 "	0.46	46 00
	4/C 14			
	FLEXIBLE CABLE			
	2/C · 6	100 "	2.60	260 00
	3/C - 6	100 "	3.50	350 00
	4/C 6	100 "	4.20	420 00
	-/C 8	100 "	2.20	220 00
	3/C 8	100 "	2.60	260 00
	-/C 12	800 "	1.20	960 00
	3/C 12	200 "	1.40	280 00
				3168 00

ESTIMATE **HARZA ENGINEERING COMPANY**
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 8 of 9 Pages

Structure ELECTRICAL, PLAN # 3-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	3"	2,800 FT	8.65	24,220.00
	2"	2,200 "	5.27	11,594.00
	1½"	1,000 "	3.40	3,400.00
	1¼"	500 "	2.65	1,325.00
	1"	1,000 "	2.14	2,140.00
	3/4"	2,000 "	1.72	4,300.00
	ALLOWANCE FOR CONCRETE CUTTING	1	-	5,000.00
	FLEXIBLE CONDUITS			
	2"	50 "	8.60	430.00
	1½"	100 "	7.00	700.00
	1"	100 "	3.80	380.00
	3/4"	100 "	3.25	325.00
Y	MOTOR CONNECTIONS	16	50.00	800.00
	L.S.	8	300.00	2,400.00
	L.S	4	50.00	200.00
Z	INSERTS AND HANGERS			
AA	EXPANSION JOINTS	—	—	—
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	1,500 FT	3.60	5,400.00
	4/0 AWG	500 "	2.10	1,050.00
	4 AWG	2,200 "	0.70	1,540.00
2AB	GRD PLATE	6	150.00	900.00
				66,104.00

ESTIMATE

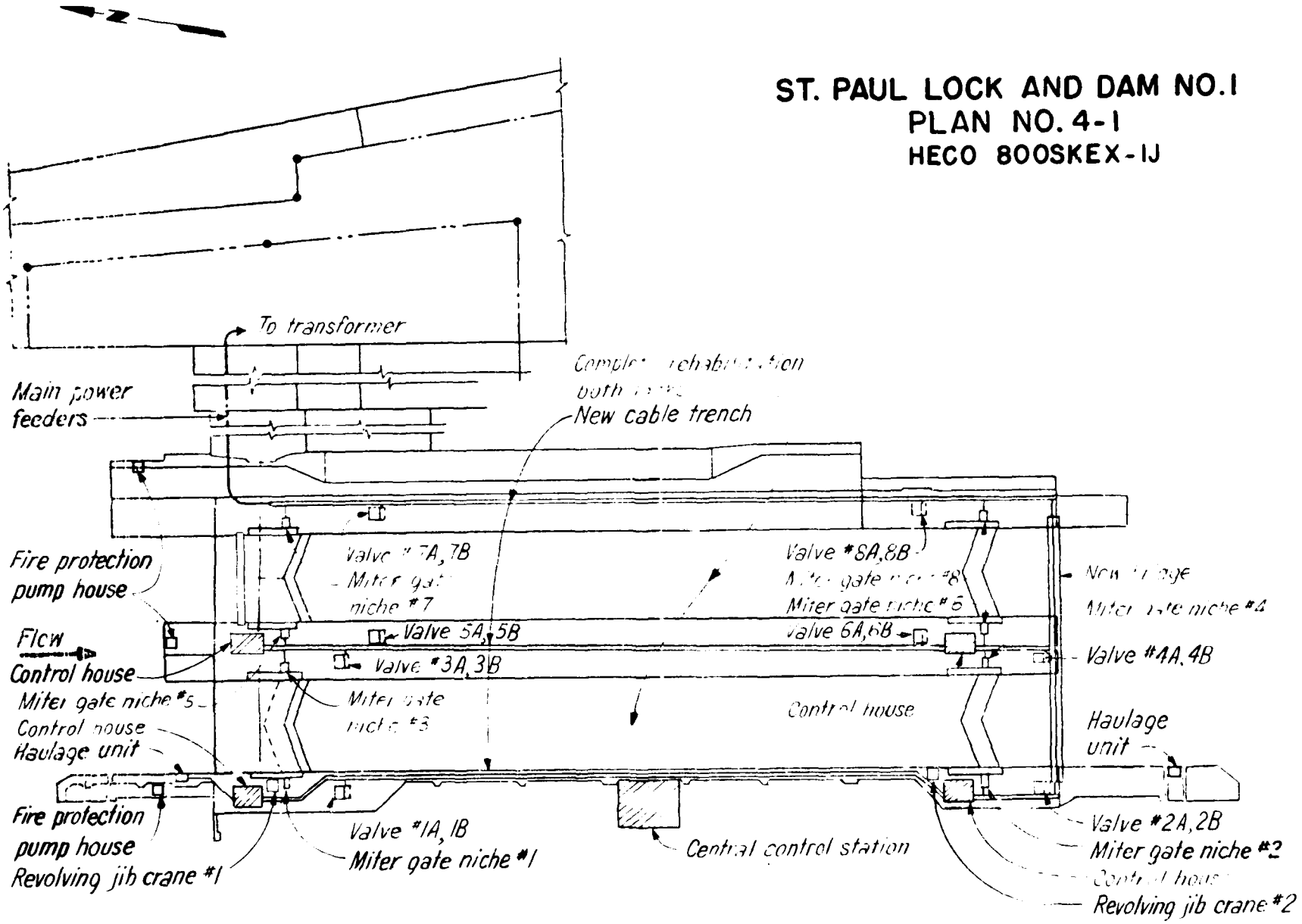
HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 9 of 9 Pages

Structure ELECTRICAL PLANT 3-2 Estimated by AKK Checked by CRR

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATES	LS	500.00	500 00
AD	WELDING	LS	2,000.00	2 000 00
AE	STRUCTURAL STEEL	LS	2,000.00	2 000 00
AF	PAINTING	LS	2,000.00	2 000 00
AC	TESTING AND INSPECTION	LS	5,000.00	5 000 00
AH	CATHODIC TREATMENT OF MITER GATES	LS	24,000.00	24 000 00
				35 500 00

ST. PAUL LOCK AND DAM NO.1
PLAN NO. 4-1
HECO 800SKEX-IJ



ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 1 of 2 Pages

Structure ELECTRICAL, PLAN 4-1 Estimated by AICK Checked by JCA

Item No.	ITEM	Quantity	Unit Price	Amount
	TEMPORARY INSTALLATION			
A	ELECTRICAL EQUIPMENT (PERMANENT EQUIP)	LS	20,000.00	20,000.00
	a, POWER CENTER 1			
	b, MOTOR CONTROL CENTER 2			
	c CONTROL DESK 4			
	d LIGHTING TRANSFORMERS 16			
	e LIGHTING PANELS			
	f TRAFFIC PANELS			
	g LMCP			
	h [illegible]			
B	[illegible] NT FIXTURE)	LS	3,500.00	3,500.00
	LOCK LIGHTS			
	NAVIGATION LIGHTS			
	[illegible]			
	[illegible] AND VALVE HOUSE LIGHTING			
C	ENCLOSURE 4	LS	4000.00	4,000.00
D	WIRE AND CABLE		85,000.00	85,000.00
E	OVERHEAD [illegible] CABLES	LS	2000.00	2,000.00
				114,500.00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM # 1 Date 12/74 Page 2 of 2 Pages

Structure ELECTRICAL PLANT 4-1 Estimated by AKK Checked by JCA

Item No.	ITEM	Quantity	Unit Price	Amount
F	MOTOR CONNECTIONS	25	50.00	1 250 00
G	MAINTENANCE	LS	20,000.00	20 000 00
H	DISCONNECTION AND REMOVAL OF ALL ELECTRICAL EQUIPMENTS LIGHTS AND CABLES	LS	10,000.00	10 000 00
				31 250 00

PAGE 1 114,500.00 ✓
PAGE 2 31,250.00 ✓
145,150.00 ✓

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Project ST. PAUL LOCK AND DAM # 1 Date 12/74 Page 1 of 9 Pages

Structure ELECTRICAL PLAN # 4-1 Estimated by CAD AFK Checked by DAH RRP

Item No.	ITEM	Quantity	Unit Price	Amount
	VALVES & JIB CRANES			2 000 00
	FIRE PROTECTION			21 301 00
	PAGE 2			175 576 00
	PAGE 3			23 [illegible] 00
	PAGE 4			52 925 00
	PAGE 5			15 832 80
	PAGE 6			263 634 50
	PAGE 7			5 966 00
	PAGE 8			99 819 00
	PAGE 9			65 000 00
1	TOTAL (LANDWARD AND RIVERWARD LOCK)			725 978 30
2	TEMPORARY INSTALLATION			145 750 00
3	REMOVAL OF EXISTING INSTALLATION			6 000 00
	TOTAL 1, 2 AND 3			877 728 30
	OVERHEAD AND PROFIT 25%			219 432 00
	SUB-TOTAL			1 097 160 00
	CONTINGENCY 10%			109 716 00
	GRAND TOTAL			$1 206 876 00
	USE			1 210 000 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 2 of 9 Pages

Structure ELECTRICAL, PLAN #4-1 Estimated by AKK Checked by [illegible]

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9,200.00	9 200 00
B	MOTOR CONTROL CENTER (CC5)	1	8,660.00	8 660 00
C	MOTOR CONTROL CENTER (CC1, CC3)	2	17,800.00	35 600 00
D	MOTOR CONTROL CENTER (CC2, CC4)	2	20,700.00	41 400 00
E	LIGHTING PANEL (DPB1, DPB6)	2	725.00	1 450 00
F	LIGHTING PANEL (DP32, DPB7)	2	740.00	1 480 00
G	LIGHTING PANEL (DPB3, DPB8)	2	610.00	1 220 00
I	LIGHTING PANEL (DPB4, [illegible])	2	870.00	1 740 00
	LIGHTING PANEL (DPB5)	1	820.00	820 00
J	TRANSFORMERS			
J1	400AMPS ACBS, 3 POLE, 480V	1	1300.00	1 300 00
J2	LIGHTING [illegible] 15 [illegible]	9	690.00	6 210 00
J3	LIGHTING [illegible] 3 KVA	6	216.00	1 296 00
K	UP[illegible] DLSK (CD1, CD3)	2	15,500.00	31 000 00
L	DOWN STREET CONTROL DESK (CD2, CD4)	2	15,500.00	31 000 00
M	TRAFFIC PANEL	2	1600.00	3 200 00
				175 376 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLAN #4-1 Estimated by AKK Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL (LMCP)	1	7,000.00	7 000 00
O	HAULAGE UNIT	2	1,200.00	2 400 00
P	REMOTE CONTACTOR			
1P	NEMA SIZE 0, 2 POLE IN NEMA 4 ENCLOSURE	8	140.00	1 120 00
Q	DISCONNECT PLUGS AND RECEPTACLE			
1Q	200 Amp, 600V, 3W, 3°	1	420.00	420 00
2Q	100 AMP, 600V, 3W, 3P	12	240.00	2 880 00
3Q	60 AMP, 600V, 3W, 3P without plug	6	80.00	480 00
4Q	60 AMP 600V, 2W, 2P	9	144.00	1 296 00
5Q	30 AMP, 600V, 3W, 3P	34	84.00	2 856 00
7Q	20 AMP, 600V, 2W, 2°	10	80.00	800 00
	15 AMP, 125V, 3W, 3P	10	36.00	360 00
9Q	15 AMP, 125V, 3W, 2P	26	32.00	832 00
10Q	15 AMP, 125V, 3W, 2°	40	30.00	1 200 00
11Q	15 AMP, 125V, 3W, 2P DUPLEX	44	30.00	1 320 00
12Q	15 AMP, 125V, 3W, 2° DUP. WITH WEATHER PROOF BOX	32	30.00	960 00
				23 924 00

ESTIMATE

HARZA ENGINEERING COMPANY
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Structure ELECTRICAL, PLAN 4-1 Estimated by AKK Checked by CRE

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCHES			
1R	15A, 125V SPST	40	30.00	1200 00
2R	15A, 125V SPST IN WEATHERPROOF BOX	40	35.00	1400 00
3R	TRANSFER SWITCH IN NEMA 4 ENCL	34	100.00	3400 00
S	MISCELLANEOUS ITEMS			
S	WALL LEVEL TRANSMITTER	2	1700.00	3400 00
2S	BELL AND HORNS			
	4" 6-10V INDOOR	1	20.00	20 00
	10" 115 V. OUTDOOR	1	85.00	85 00
	10" DC WEA. HORN	1	105.00	105 00
	HORN 12 V DC 110DB	1	115.00	115 00
T	LIGHTING			
	POLE LIGHTING			
	TYPE A	28	840.00	23 520 00
	TYPE B	12	840.00	10 080 00
	TYPE D	2	1400.00	2 800 00
	TYPE E	1	1400.00	1 400 00
	TYPE F	2	1400.00	2 800 00
	TYPE G	2	1300.00	2 600 00
				52 925 00

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL, PLANT 4-1 Estimated by AICK Checked by ERE

Item No.	ITEM	Quantity	Unit Price	Amount
	LIGHTING (CONT.)			
	TYPE H	2	1150.00	2 300 00
	TYPE J	2	1150.00	2 300 00
	FLUORESCENT AND INCANDESCENT			
	FIXTURE			
	TYPE A	12	113.00	1 356 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1 482 00
	TYPE D	10	35.00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	12	40.00	480 00
	TYPE H	8	35.00	280 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE HIND VDA 2857	4	50.00	200 00
	CROUSE HIND WEATHER RESISTANT	32	40.00	1 280 00
	CROUSE HIND WEATHER RESISTANT	8	40.00	320 00
	FLOOD LIGHT - SCL REVERE	32	70.00	2 240 00
	FLOATING MOORING BITT LIGHT	6	210.00	1 260 00
	EMERGENCY LIGHT UNIT	3	275.00	825 00
	LAMPS			
	40W FLUORESCENT	74	1.70	125 80
	150W INCANDESCENT	109	1.00	109 00
	100W "	80	0.70	56 00
	60W "	50	0.62	31 00
				15 832 80

ESTIMATE HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL, PLANT 4-1 Estimated by AKF Checked by CCC

Item No.	ITEM	Quantity	Unit Price	Amount		
V	JUNCTION BOXES					
IV	JB 1, 2, 3, 4, 5, 6, 7, 8; JB V 1, 2, 3, 4, 5, 6, 7, 8 JB 3, 4, 7, 8, NEMA 4 ENCL WITH TB	20	425 00	8,	500	00
2V	JB 1, 2, 5, 6 NEMA 1 ENCL WITH TB	4	50 00		200	00
3V	OTHER BOXES	LS	1,500 00	1,	500	00
W	CABLE AND WIRES					
	1/c - 1/0	3500 FT	1.60	5	600	00
	1/c - 500 MCM	13,500 "	4.10	55	350	00
	1/c - 4/0 AWG	6,400 "	2.35	15	040	00
	1/c - 1	2,600 "	1.18	3	068	00
	1/c - 4	24,000 "	0.75	18	000	00
	1/c - 6	21,000 "	0.55	11	550	00
	1/c - 8	10,000 "	0.32	3	200	00
	1/c - 10	5,000 "	0.25	1	500	00
	1/c - 12	10,000 "	0.19	1	900	00
	1/c - 14	1,800 "	0.13		234	00
	12/c - 10	4,700 "	0.58	2	726	00
	3/c - 10	3,200 "	0.81	2	592	00
	4/c - 10	3,000 "	1.20	3	600	00
	2/c - 12	14,000 "	0.42	5	880	00
	3/c - 12	4,100 "	0.70	2	870	00
	4/c - 12	150 "	0.83		124	50
	6/c - 12	12,000 "	1.23	14	760	00
	9/c - 12	20,000 "	1.80	36	000	00
	12/c - 12	32,000 "	2.17	69	440	00
				263	634	50

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLAN #4-1 Estimated by AKK Checked by EBE

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLE AND WIRES (CONT.)			
	2#/C - 12 AWG	100 FT	3.75	375 00
	2/C - 14	2400 "	0.31	744 00
	3/C - 14	200 "	0 46	92 00
	FLEXIBLE CABLE			
	2/C - 6 AWG	150 "	2.60	390 00
	3/C "	150 "	3.50	525 00
	4/C "	150 "	4.20	630 00
	4/C 8	250 "	2.20	550 00
	3/C 8	150 "	2.60	390 00
		1,600 "	1.20	1920 00
		250 "	1.40	350 00
				5 966 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLAN #4-1 Estimated by AICK Checked by CRE

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	3"	4,000 FT	8.65	34 600 00
	2"	4,200 "	5.27	22 134 00
	1½"	1,000 "	3.40	3 400 00
	1¼"	500 "	2.65	1 325 00
	1"	1,000 "	2.14	2 140 00
	¾"	3,500 "	1.72	6 020 00
	ALLOWANCE FOR CONCRETE CUTTING	1	—	10 000 00
	FLEXIBLE CONDUITS			
	[illegible]"	50 "	8.60	430 00
	[illegible]"	100 "	7.00	700 00
	[illegible]"	100 "	3.80	380 00
	[illegible]"	100 "	3.25	325 00
Y	CONNECTIONS			
1Y	MOTORS	32	50.00	1 600 00
2Y	LIMIT SWITCH	16	300.00	4 800 00
3Y	LIMIT SWITCH	8	50.00	400 00
Z	TRENCH AND HANDHOLES			
	[illegible] FOR FOUNDATION	—		
AA	EXPANSION JOINTS	—	—	—
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	2,000 FT	3.60	7 200 00
	4/0 AWG	650 "	2.10	1 365 00
	4 AWG	3,000 "	0.70	2 100 00
2AB	GRD PLATE	6	150.00	900 00
				99 819 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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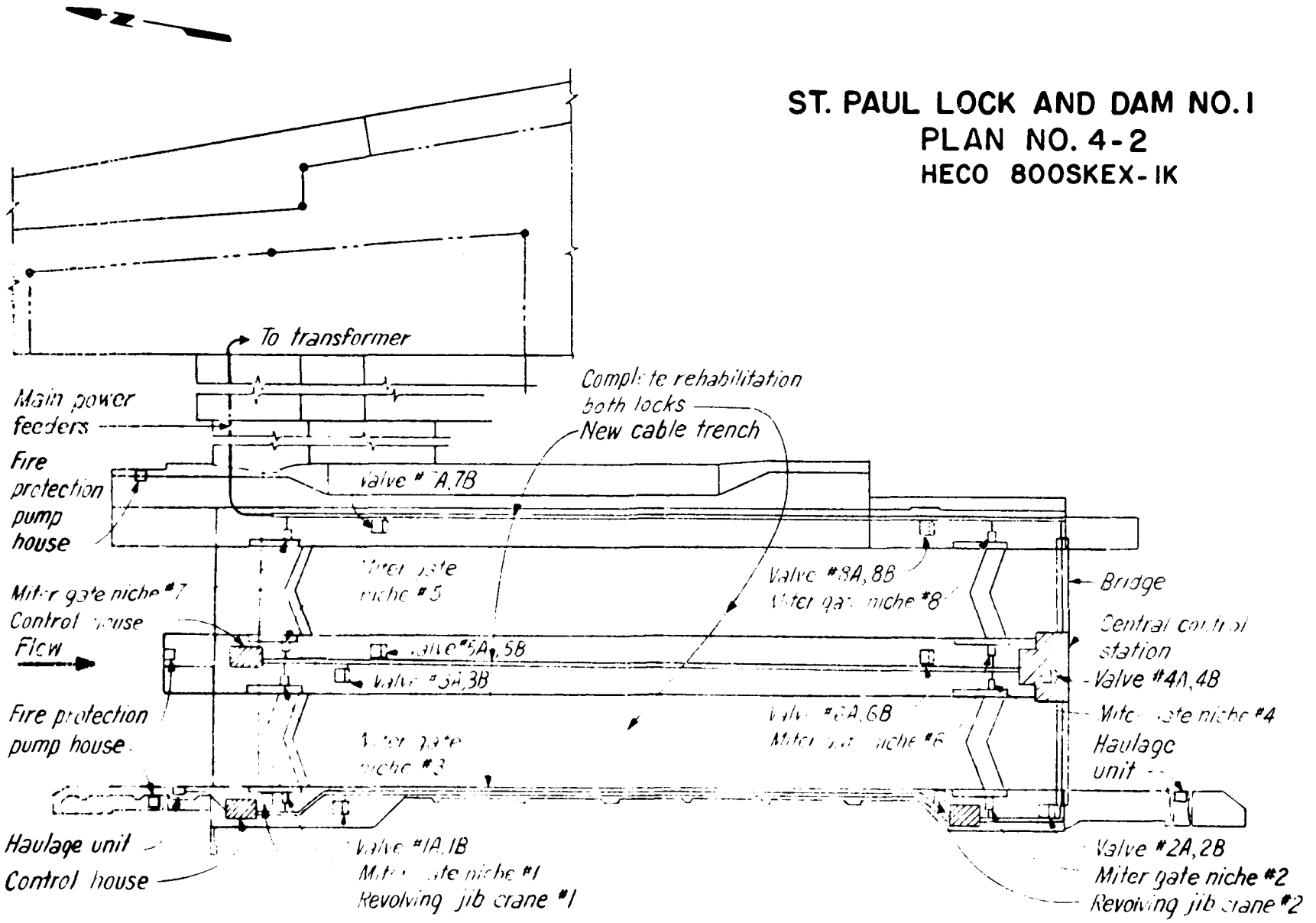
Structure ELECTRICAL PLAN #4-1 Estimated by AKK Checked by CBR

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATES	LS	1000.00	1 000 00
AD	WELDING	LS	3,000.00	3 000 00
AE	STRUCTURAL STEEL	LS	3 200.00	3 000 00
AF	PAINTING	LS	3 000.00	3 000 00
AG	TESTING	LS	7,000.00	7 000 00
AH	CATHODIC PROTECTION OF MITER GATES	LS	48000.00	48 000 00
				65 000 00

ST. PAUL LOCK AND DAM NO. 1
PLAN NO. 4-2
HECO 800SKEX-IK



ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL, PLAN #4.2 Estimated by AKK Checked by JCA

Item No.	ITEM	Quantity	Unit Price	Amount
	TEMPORARY INSTALLATION			
A	ELECTRICAL EQUIPMENT (PEMANENT EQUIP	LS	20,000.00	2000000
	a, POWER CENTER 1			
	b, MOTOR CONTROL CENTER -5			
	c, CONTROL DESK -4			
	d, LIGHTING TRANSFORMER 9+6			
	e, LIGHTING PANELS			
	f, TRAFFIC PANELS			
	g, LMCP			
	h, HAULAGE UNIT			
B	LIGHTING ([illegible] IT FIXTURES)	LS	3500 00	350000
	LOCK LIGHTS			
	NAVIGATION LIGHTS			
	TRAFFIC LIGHTS			
	ENCLOSURE [illegible] AND			
	VALVES RECESSES, GATE LIGHTS			
C	ENCLOSURES 4	LS	4000.00	400000
D	WIRES AND CABLES	LS	85,000.00	8500000
E	OVERHEAD [illegible]	LS	2000.00	200000
				11450000

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLAN "4.2 Estimated by AKK Checked by JCA

Item No.	ITEM	Quantity	Unit Price	Amount
F	MOTOR CONNECTIONS	25	50.00	1 25000
G	MAINTENANCE	LS	20,000.00	20 000 00
H	DISCONNECTION AND REMOVAL OF ALL ELECTRICAL EQUIPMENTS, LIGHTS AND CABLES	LS	10,000.00	10 000 00
				31 25000
	PAGE 1 114 500.00			
	PAGE 2 31 250.00			
	TOTAL 145,750.00			

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLAN #4-2 Estimated by AICK Checked by CRE

Item No.	ITEM	Quantity	Unit Price	Amount
	VALVES & JIB CRANES			2 000 00
	FIRE PROTECTION			21 301 00
	PAGE 2			175 576 00
	PAGE 3			23 924 00
	PAGE 4			52 925 00
	PAGE 5			15 832 00
	PAGE 6			268 759 00
	PAGE 7			5 568 00
	PAGE 8			99 819 00
	PAGE 9			65 000 00
1	TOTAL (LANDWARD AND RIVERWARD LOCK)			730 704 00
2	TEMPORARY INSTALLATION			145 750 00
3	REMOVAL OF EXISTING INST...			6 000 00
	TOTAL 1, 2 AND 3			882 454 00
	OVERHEAD AND PROFIT 25%			220 613 00
	SUB-TOTAL			1 103 067 00
	CONTINGENCY 10%			110 306 00
	GRAND TOTAL			$1 213 373 00
	USE			1 215 000 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL, PLAN #4.2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
A	LOAD CENTER	1	9,200.00	9 200 00
B	MOTOR CONTROL CENTER (CC5)	1	8660.00	8 660 00
C	MOTOR CONTROL CENTER (CC1, CC3)	2	17.800.00	35 600 00
D	MOTOR CONTROL CENTER (CC2, CC4)	2	20.700.00	41 400 00
E	LIGHTING PANEL (DPB5, DPB6)	2	725.00	1 450 00
F	LIGHTING PANEL (DPB2, DPB7)	2	740.00	1 480 00
G	LIGHTING PANEL (DPB3, DPB8)	2	610.00	1 220 00
H	LIGHTING PANEL (DPB4, DPB9)	2	870.00	1 740 00
I	LIGHTING PANEL (DPB5)	1	820.00	820 00
J	[illegible]			
J1	400 AMPS ACBS [illegible] 480V	1	1.300.00	1 300 00
J2	LIGHT [illegible]	2	6[illegible]	6 210 00
J3	LIGHTING [illegible] 3 KVA	6	216.00	1 296 00
K	UPSTREAM [illegible] (CD1, CD3)	2	15,500.00	31 000 00
L	DOWNSTREAM [illegible] (CD2, CD4)	2	15,500.00	31 000 00
M	TRAFFIC PANEL	2	1.600.00	3 200 00
				175 576 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL, PLAN #4-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
N	LOCK MASTER CONTROL PANEL (LMCP)	1	7,000.00	7,000.00
O	HAULAGE UNIT	2	1,200.00	2,400.00
P	REMOTE CONTROL			
	NEMA SIZE 0, 2 POLE IN NEMA 1 ENCLOSURE	8	140.00	1,120.00
Q	DISCONNECT PLUGS AND RECEPTACLES			
1Q	200 AMP, 600V, 3W, 3P	1	420.00	420.00
2Q	100 AMP, 600V, 3W, 3P	12	240.00	2,880.00
3Q	60 AMP, 600V 3W, 3P WITHOUT PLUG	6	80.00	480.00
4Q	60 AMP, 600V, 2W, 2P	9	144.00	1,296.00
5Q	30 AMP, 600V 3W, 3P	34	84.00	2,856.00
7Q	20 AMP, 600V, 2W, 2P	10	80.00	800.00
8Q	15 AMP, 125V, 3W, 3P	10	36.00	360.00
9Q	15 AMP, 250V, 3W, 3P	26	32.00	832.00
10Q	15 AMP, 125V, 3W, 2P	40	30.00	1,200.00
11Q	15 AMP, 125V, 3W, 2P DUPLEX	44	30.00	1,320.00
12Q	15 AMP, 125V, 3W, 2P DUPLEX	32	30.00	960.00
	WEATHERPROOF BOX			
				23,924.00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 4 of 9 Pages

Structure ELECTRICAL PLAN #4-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
R	TOGGLE SWITCHES			
1R	15A 125/SPST	40	30.00	1200 00
2R	15A, 125V SPST IN WEATHERPROOF BOX	40	35.00	1400 00
3R	TRANSFER SWITCH IN NEMA #4 ENCL	34	100.00	3400 00
S	MISCELLANEOUS ITEMS			
1S	WATER LEVEL TRANSMITTER	2	1700.00	3400 00
2S	BELL AND HORN			
	4" 8-10 VOLTS INDOOR	1	220	20 00
	10" 115 VOLTS OUTDOOR	1	85.00	85 00
	TWO WAY HORN	1	105.00	105 00
	HORN 125 V DC INDOOR	1	115.00	115 00
T	LIGHTING			
	DOCK LIGHTING			
	TYPE A	28	840.00	23520 00
	TYPE B	12	840.00	10080 00
	TYPE D	2	1400.00	2800 00
	TYPE E	1	1400.00	1400 00
	TYPE F	2	1400.00	2800 00
	TYPE G	2	1300.00	2600 00
				52925 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 5 of 9 Pages

Structure ELECTRICAL PLAN #4-2 Estimated by AKK Checked by CRC

Item No.	ITEM	Quantity	Unit Price	Amount
	LIGHTING (CONT.)			
	TYPE H	2	1150.00	2 300 00
	TYPE J	2	1150.00	2 300 00
	FLUORESCENT AND INCANDESCENT			
	FIXTURES:			
	TYPE A	12	113.00	1 356 00
	TYPE B	14	34.00	476 00
	TYPE C	19	78.00	1 482 00
	TYPE D	10	35.00	350 00
	TYPE E	6	37.00	222 00
	TYPE G	12	40.00	480 00
	TYPE H	2	140.00	280 00
	TYPE I	1	30.00	30 00
	TYPE J	2	35.00	70 00
	TYPE K	1	40.00	40 00
	CROUSE HIND VDA 295	4	50.00	200 00
	CROUSE HIND WEATHER RESISTANT	32	40.00	1 280 00
	CROUSE HIND WEATHER RESISTANT	8	40.00	320 00
	FLOOD LIGHTS [illegible]	32	70.00	2 240 00
	FLOATING MOORING BITT LIGHTS	6	210.00	1 260 00
	EMERGENCY LIGHT UNIT	3	275.00	825 00
	LAMPS			
	40 W FLUORESCENT	74	1.70	125 80
	100 W INCANDESCENT	109	1.00	109 00
	100 W	80	0.70	56 00
	60 W	50	0.62	31 00
				15 832 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/75 Page 6 of 9 Pages

Structure ELECTRICAL, PLAN #4-2 Estimated by AKK Checked by CRP

Item No.	ITEM	Quantity	Unit Price	Amount
V	JUNCTION BOXES			
IV	JBG1,2,3,4,5,6,7,8, JBV1,2,3,4,5,6,7,8 JB3,4,7,8 NEMA 4 ENCL WITH TB	20	425.00	8 500 00
2V	JB 1,2,5,6 NEMA 1 ENCL WITH TB	4	50.00	200 00
3V	OTHER BOXES	LS	1,500.00	1,500 00
W	CABLE AND WIRES			
	1/C - 500 MCM	12,000 FT	4.10	49 200 00
	1/C - 4/0 AWG	4,100 "	2.35	9 635 00
	1/C - 1/0 AWG	3,500 "	1.60	5 600 00
	1/C 1	2,600 "	1.18	3 068 00
	1/C 4	19,000 "	0.75	14 250 00
	1/C 6	27,000 "	0.55	14 850 00
	1/C 8	25,000 "	0.32	8,000 00
	1/C 10	6,000 "	0.25	1 500 00
	1/C 12	10,000 "	0.19	1900 00
	1/C 14	1,800 "	0.13	234 00
	2/C 10	4,500 "	0.58	2 610 00
	3/C 10	3,100 "	0.81	2 511 00
	4/C 10	1,500 "	1.20	1 800 00
	2/C 12	12,000 "	0.42	5040 00
	3/C 12	4,000 "	0.70	2 800 00
	4/C 12	200 "	0.83	166 00
	6/C 12	12,000 "	1.23	14 760 00
	9/C 12	21,000 "	1.80	37 800 00
	12/C 12	38,000 "	2.17	82 460 00
	24/C 12	100 "	3.75	375 00
				268 759 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST PAUL LOCK AND DAM #1 Date 12/74 Page 7 of 9 Pages

Structure ELECTRICAL, PLAN #4-2 Estimated by AKK Checked by CPP

Item No.	ITEM	Quantity	Unit Price	Amount
	CABLE AND WIRES (CONT.)			
	2/C - 14 AWG	2400 FT	0.31	744 00
	3/C - 14 AWG	150 "	0.46	69 00
	FLEXIBLE CABLE			
	2/C 6 AWG	150 "	2.60	390 00
	3/C 6	150 "	3.50	525 00
	4/C 6	150 "	4.20	630 00
	2/C - 8	250 "	2.20	550 00
	3/C - 8	150 "	2.60	390 00
	2/C 12	1,600 "	1.20	1 920 00
	3/C 12	250 "	1.40	350 00
				5 568 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

Project ST. PAUL LOCK AND DAM #1 Date 12/74 Page 8 of 9 Pages

Structure ELECTRICAL PLAN # 4-2 Estimated by AKK Checked by CBC

Item No.	ITEM	Quantity	Unit Price	Amount
X	CONDUITS			
	2 1/2"	4,000 FT	8.65	34 600 00
	2"	4,200 "	5.27	22 134 00
	1 1/2"	1,000 "	3.40	3 400 00
	1 1/4"	500 "	2.65	1 325 00
	1"	1,000 "	2.14	2 140 00
	3/4"	3,500 "	1.72	6 020 00
	ALLOWANCE FOR CONCRETE CUTTING	1		10 000 00
	FLEXIBLE CONDUITS			
	2"	50 "	8.60	430 00
	1 1/2"	100 "	7.00	700 00
	1"	100 "	3.80	380 00
	3/4"	100 "	3.25	325 00
Y	CONNECTIONS			
1Y	MOTORS	32	50.00	1 600 00
2Y	LIMIT SWITCH	16	300.00	4 800 00
3Y	LIMIT SWITCH	8	50.00	400 00
Z	TOOL AND HANDHOLES	—	—	—
AA	EXPANSION JOINT	—	—	—
AB	GROUNDING			
1AB	GROUND CABLE			
	500 MCM	2,000 FT	3.60	7 200 00
	4/0 AWG	650 "	2.10	1 365 00
	4 AWG	3,000 "	0.70	2 100 00
2AB	GRD PLATE	6	150.00	900 00
				99 819 00

ESTIMATE

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

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Structure ELECTRICAL PLAN #4-2 Estimated by AKK Checked by CRO

Item No.	ITEM	Quantity	Unit Price	Amount
AC	NAME PLATES	LS	1000.00	1 000 00
AD	WELDING	LS	3,000.00	3 000 00
AE	STRUCTURAL STEEL	LS	3,000.00	3 000 00
AF	PAINTING	LS	3,000.00	3 000 00
AG	TESTING AND INSPECTION	LS	7000.00	7 000 00
AH	CATHODIC PROTECTION OF MITER GATE	LS	48,000.00	48 000 00
				65 000 00

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1210 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER
STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO.1
MINNEAPOLIS, MINNESOTA

APPENDIX J
CENTRAL CONTROL STATION AND ACCESS BRIDGE

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

PLATES

Appendix J

CENTRAL CONTROL STATION AND ACCESS BRIDGE

Alternate Locations

1. Control Station on Land Wall. As shown on Plate J-1 the central control station is located on Monoliths 9 and 10 of the existing land wall. This control house contains a roofed observation deck at El. 754.7, control room, office and toilet at El. 743.7, a machine stop and toilet at El. 732.7, and an equipment and storage room at El. 722.7. Included also are public and private stairways and a common use elevator.

The access bridge starts on Monolith 18 of the land wall as shown on Plate J-2, and includes an elevator to the lower gallery.

2. Control Station on Intermediate Wall. As shown on Plate J-2, the location of the control house is on Monoliths 18 and 19 of the existing intermediate wall. This control house contains a control room, office and toilet at El. 762.5 and machinery room, toilet and storage at El. 751.5. Included is an elevator and stairway to the intermediate wall.

The access bridge is located on Monolith 19 as shown on Plate J-2, and includes an elevator to the lower gallery.

3. Monitoring System. If both locks are rehabilitated, regardless of the CCS location, an electronic signal monitoring system, including television surveillance, shall be used.

4. Flooding. Flooding could occur once in 10 years, but can be prevented by using sandbags. However, in the event of flooding no damage would be caused to the physical plant that could not be remedied by cleaning. Other damage would depend on the equipment located below flood elevation.

Exterior Treatment

5. General. Exterior materials have been selected for durability and freedom from maintenance.

6. Walls. All exterior walls shall be constructed of cast in place concrete. "V" grooves shall be used to divide the exterior facade into panels and to conceal the joint between Monoliths 8 and 9 on the land wall control house.

7. Bridge, Exterior Stairs, Elevator Shaft. The bridge may be of cast in place concrete or precast and erected into place. Stairs shall be all of cast in place concrete with steel nosings. Elevator shaft shall be of cast in place concrete with "V" grooves. The bottom cavity of the "H" shaped bridge shall be used to conceal piping. Steel grate access panels shall be cast into bridge floor with platforms beneath for piping maintenance. The bridge shall be covered with a continuous aluminum and plexiglass skydome system, providing good visibility and protection from the weather. The bridge ventilation shall come from below, thru the access grating.

8. Fenestration. Window frames shall be of aluminum. Stairwell and entrance window frames of land wall control house shall be aluminum - storefront type. All glass shall be reflective 1/4 inch polished plate glass.

9. Roof. Roof construction shall be flat slab with "Hypalon" roofing. The observation deck on land wall control house shall be flat slab with "Hypalon" roofing topped with 2 inches of asphalt covering.

10. Exterior Doors and Frames. Exterior doors and frames shall be of aluminum with 1/4 inch plate glass lites as shown on the elevations. The public entrance to the land wall control house shall be through an aluminum door and frame glazed with reflective 1/4 inch polished plate glass. The loading door to equipment and storage room in the land wall control house shall be a steel rollup door.

11. Observation Deck. The observation deck shall be a roofed open area as described in par. 9. The deck shall have no toilet facility as the duration of stay of the visitors is expected to be too short. A drinking fountain shall be provided. No other equipment or displays shall be provided for reasons of extreme vulnerability to vandalism.

Interior Treatment

12. General. Interior finishes and materials shall be selected on the basis of insulative properties, economy and ease of maintenance. On exterior walls insulative properties shall be considered prior to durability, although a practical balance shall be attained.

13. Exterior Walls. Interior surfaces of exterior walls in all areas except stairwells and elevators shall be furred with 2 by 2 inch strips with 1-1/2 inch styrofoam insulation placed against the walls between the strips. Drywall, 5/8 inches thick, shall be placed over the insulation. The drywall shall be painted.

14. Interior Walls. Concrete interior walls shall have paint applied directly to their surfaces. Other partitions shall be of 6 inch lightweight concrete blocks with paint applied directly to their surfaces.

15. Floors. Depending upon the area involved, floor finish will be either sealed concrete or precast terrazzo. Floor bases shall be similar to floor material. In the intermediate wall control house, the underside of the floor slab at El. 751.5 shall have 2 inches of styrofoam insulation applied with adhesive.

16. Ceilings. The ceilings which are roof slabs shall have 2 by 2 inch furring strips with 1-1/2 inches of styrofoam insulation placed against slab between the strips. Prefinished ceiling panels, 4 feet by 8 feet by 5/8 inches, shall be fastened to the furring strips over the insulation. Other ceilings shall be paint applied directly to the slab.

17. Interior Doors and Frames. All interior doors will be of flush panel, stainless steel type hung on stainless steel frames.

18. Interior Railings. All interior railings, whether wall or floor mounted, shall be aluminum.

19. Interior Stairs. All interior stairs shall be of cast in place concrete with non-slip nosings on all treads.

Elevators

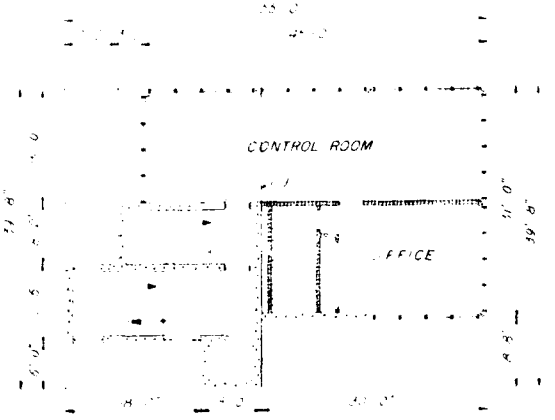
20. Elevators. Elevators shall be low speed overhead traction 3000 pound capacity passenger elevators with manufacturer's standard laminated plastic finishes. Mats shall be provided to protect finishes when elevator is converted to freight use. Controls shall be as required for each individual elevator. All electrical controls below flood elevation shall be protected.

Phase B - Possible Alternates

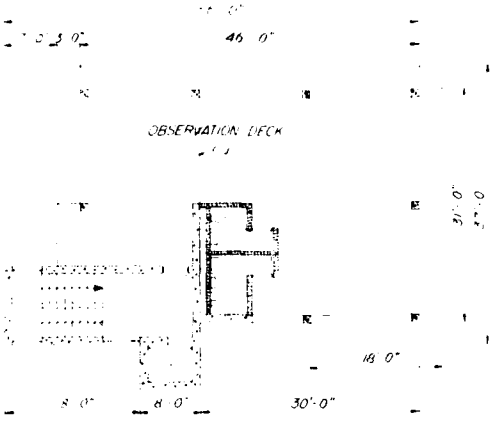
21. Shop and Storage Building. A two story Shop and Storage Building could be located adjacent to the bridge elevator. The elevator would be modified to allow its use by the building's occupants. A direct access to the lower control stand could be incorporated. The storage room would be located at El. 722.7 and the shop at El. 732.7. The Shop and Storage Building would be compatible with any of the three possible locations considered of the CCS.

22. Observation Deck. An observation deck could be located on the roof of the above-mentioned Shop and Storage Building. The deck in this location is compatible and ideal with any of the three possible locations considered of the CCS. The primary disadvantage of locating a public facility at this location is that it opens the entire land wall area for the public as access and presents a control and security problem. The solution would be to provide direct access for the public to the observation area from the bluff via a bridge.

23. Alternate Location Land Wall CCS. The Land Wall CCS could be moved near the lower miter gates. This location can be workable either with or without the Shop and Storage Building. The same control and security problem would exist and could be solved in the above-mentioned manner. This arrangement would place all functions in close proximity and be most efficient.



PLAN EL 743 7



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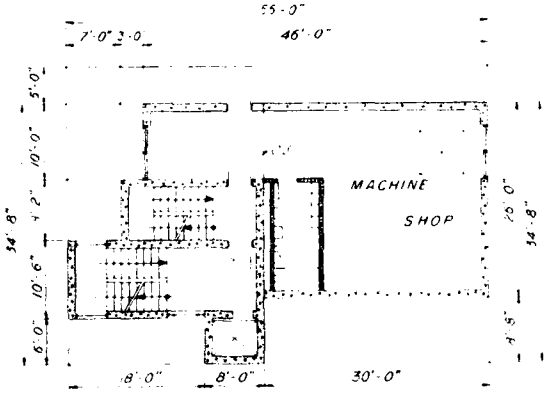

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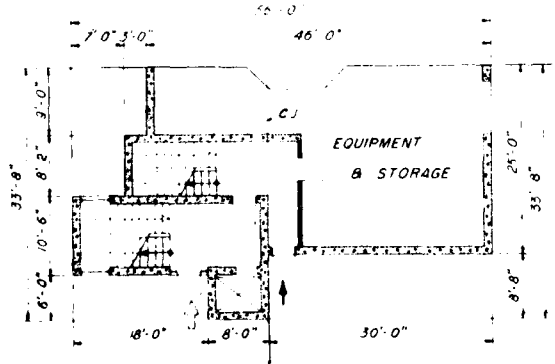
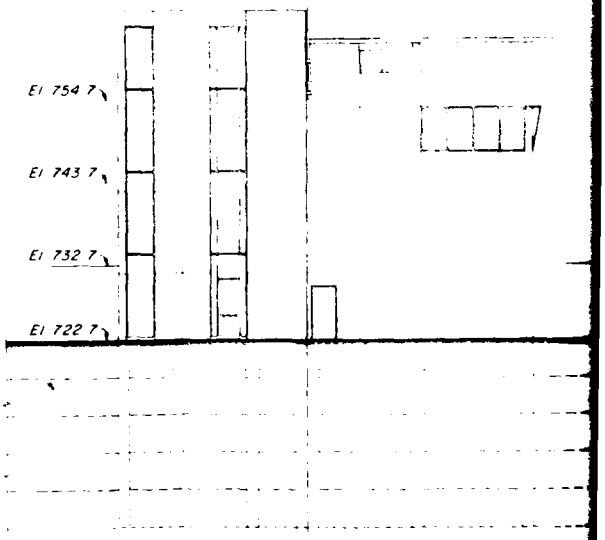
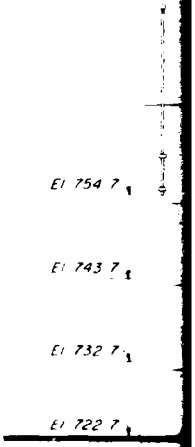


PLAN EL 722 7

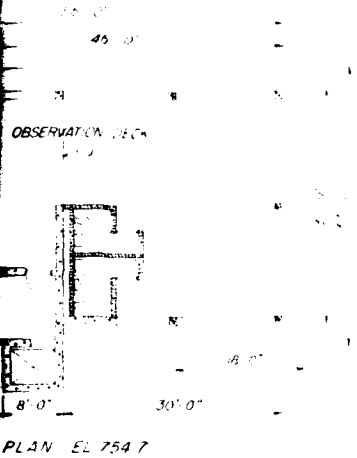
Security Fence



LAND ELEVATION



DOWNSTREAM
ELEVATION



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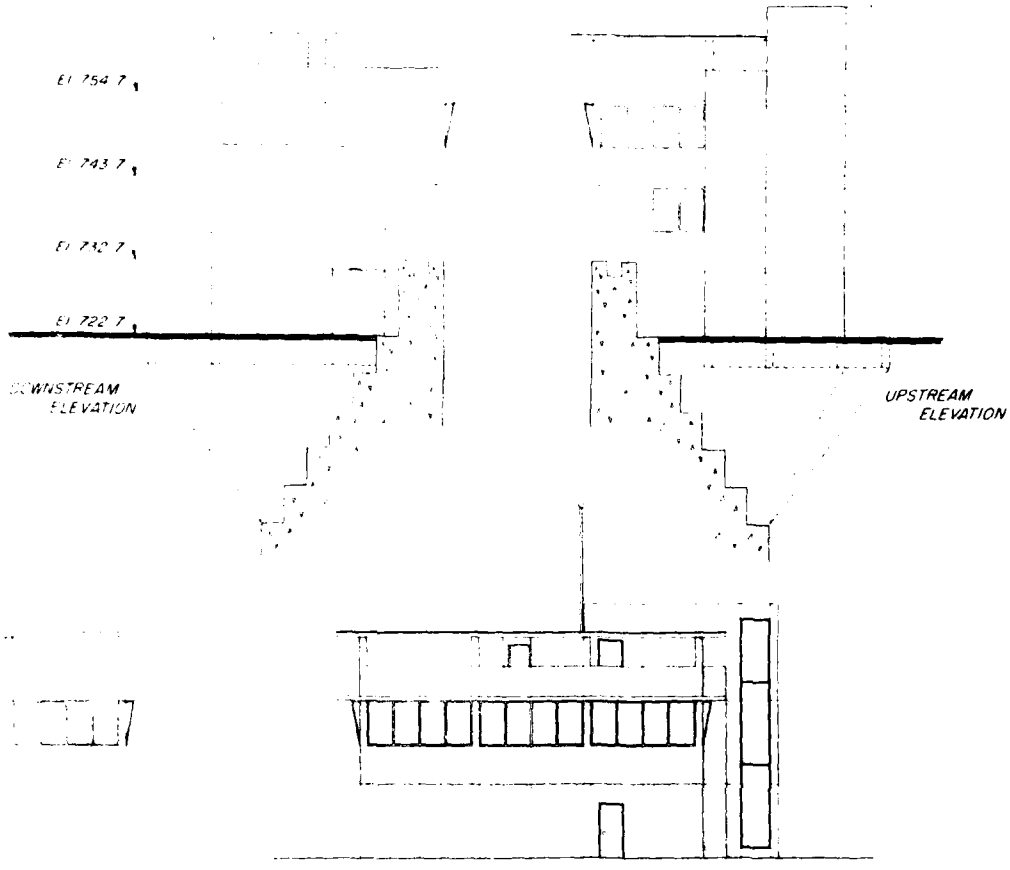
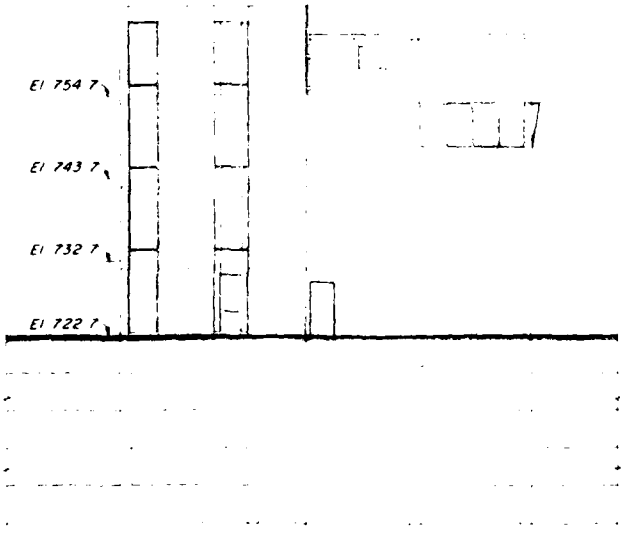


DOWNSTREAM ELEVATION

UPSTREAM ELEVATION



LAND ELEVATION

RIVER ELEVATION

SCALE IN FEET
0 5 10 15

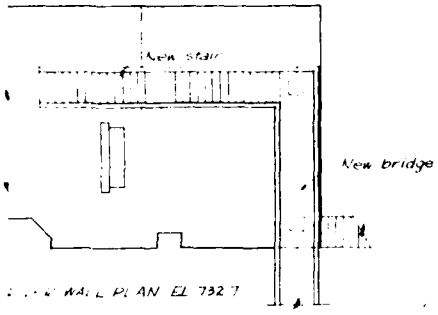
HARZA ENGINEERING COMPANY CHICAGO, ILLINOIS		DEPARTMENT OF THE ARMY ST PAUL DISTRICT, CORPS OF ENGINEERS ST PAUL, MINNESOTA	
DESIGNED BY: E.P.	STUDY OF ALTERNATIVES FOR REHABILITATION		
DRAWN BY: M V R	MISSISSIPPI RIVER	LOCK & DAM NO. 1	
TRACED BY: J M S	CENTRAL CONTROL STATION		
SUBMITTED BY:	ON LAND WALL		
APPROVED:	DATE: MARCH 1975		
	DRAWING NUMBER		
	SHEET OF		

SAFETY PAYS

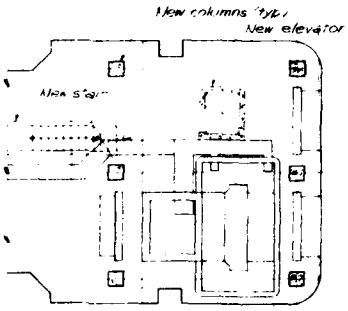
PLATE J-1

1

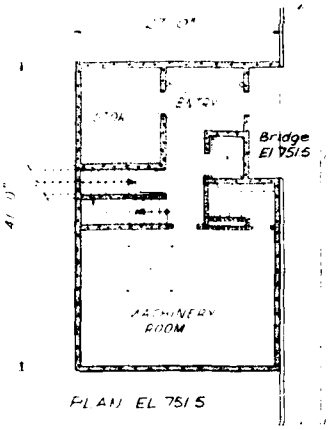
2



LAND WALL PLAN EL 732 7



INTERMEDIATE WALL PLAN EL 732 7



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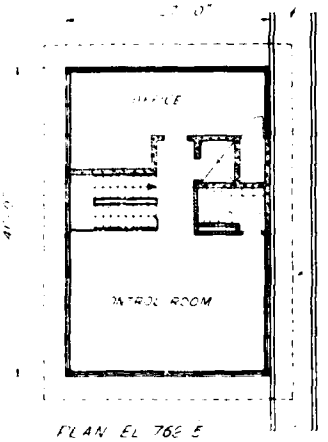

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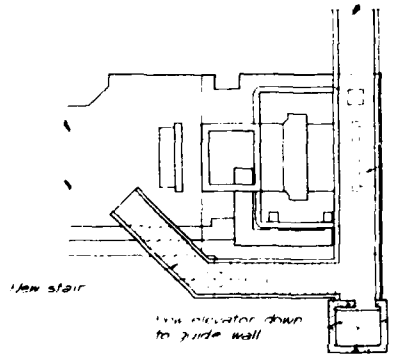
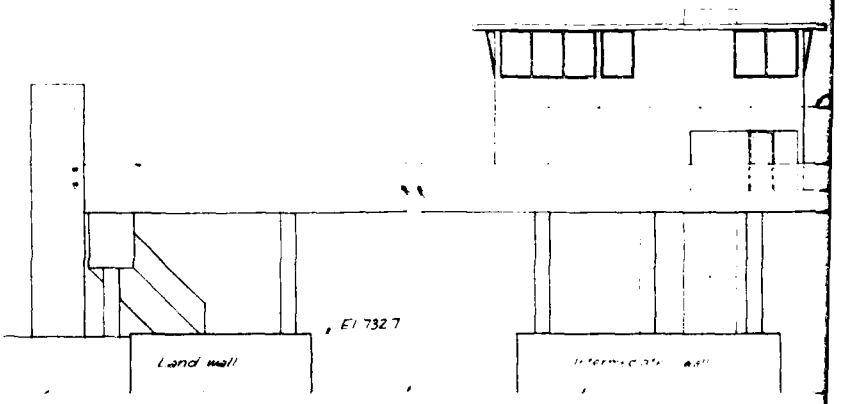


LAND WALL PLAN EL 732 7



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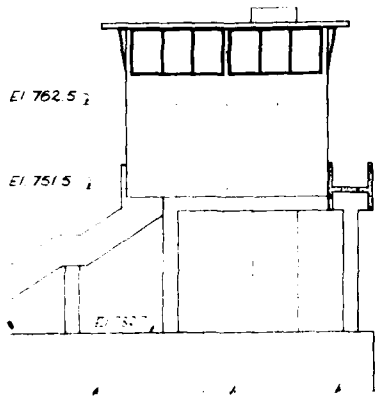

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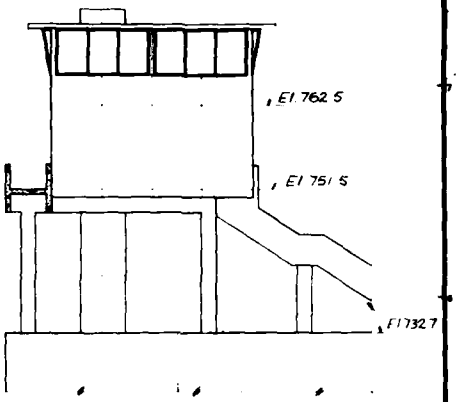
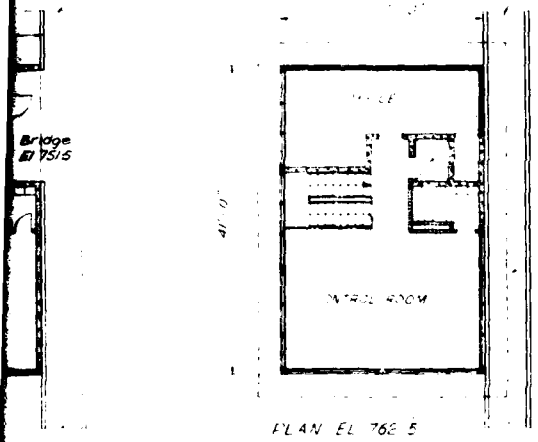
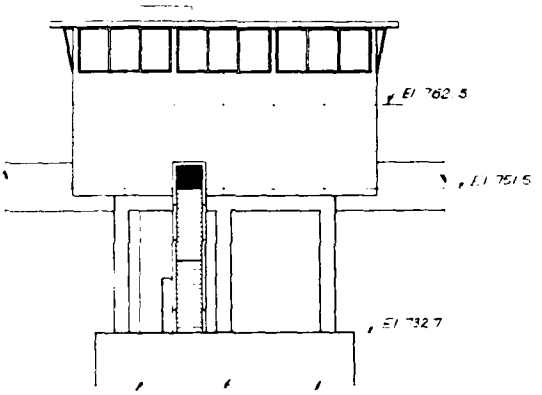


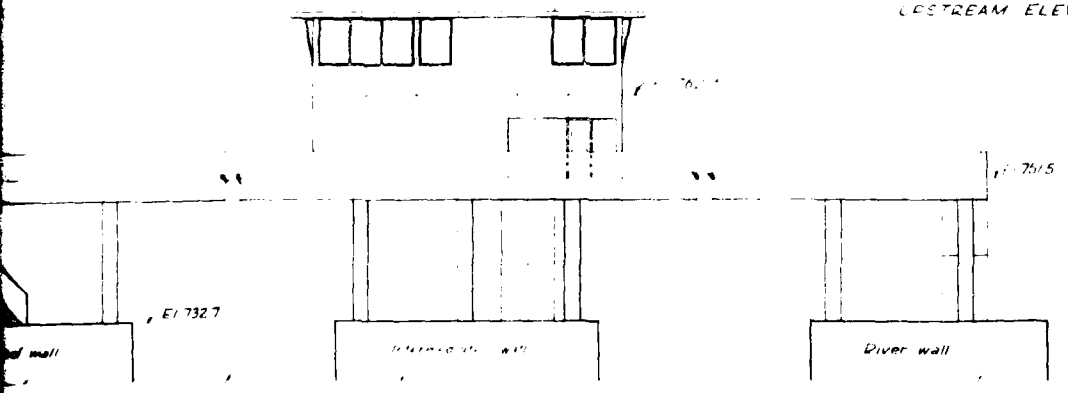
RIVER SIDE ELEVATION



PLAN EL 762.5



UPSTREAM ELEVATION



ELEVATION

HARZA ENGINEERING COMPANY
CHICAGO ILLINOIS

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT CORPS OF ENGINEERS
ST PAUL MINNESOTA

DESIGNED BY E P
DRAWN BY M V K
CHECKED BY J M S
SUBMITTED BY
APPROVED

STUDY OF ALTERNATIVES FOR REHABILITATION
MISSISSIPPI RIVER LOCK & DAM NO. 1
CENTRAL CONTROL STATION
ON INTERMEDIATE WALL

DATE
MARCH 1975

DRAWING NUMBER

SHEET OF

SAFETY PAYS

PLATE J-2

1 2

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1210 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER

STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1

MINNEAPOLIS, MINNESOTA

APPENDIX K

DAM INSPECTION

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TABLES

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DAM INSPECTION

1. Condition of Interior of Concrete Dam Structure (From Visual Observation). The 574 foot long Ambursen-type dam was inspected on October 9, 1974 by Mr. Jack Jones, Head, Special Projects Division of Harza and Mr. E. T. Moore, Project Manager. The interior was inspected from the catwalk which extends through a 3'-0" x 6'-0" opening in the buttresses of the dam from the riverward lock wall to the powerhouse at the left end of the dam. The cracks observed were apparently identical to those observed by the Corps of Engineers inspection team in August 1967, as shown on sheet 7 of 7 of the Corps of Engineers PERIODIC INSPECTION REPORT - REPORT No. 1, dated March 1971, MISSISSIPPI RIVER LOCK AND DAM No. 1 - MINNEAPOLIS, MINNESOTA.

The cracks are located in the haunch of the buttresses. None of the cracks were extended into the upstream slab or into the crest of the dam. None of the cracks appear to be serious. There is no movement, or offset at the cracks nor is there any seepage through cracks. The most extensive cracking is limited to buttresses Nos. 6 and 27 (called Arch Ribs in the Corps of Engineers Report).

It appears that some of the sand fill placed in the interior between buttresses in 1952 to reduce the possibility of failure by sliding had been removed by the subsequent floods.

Other than the cracks in the buttresses, the interior concrete looks to be in good condition. There is no evidence of structural stress or differential settlement of the adjacent buttresses which are spaced 16'0" on centers.

The dam for the greater part is supported on an alluvial fill consisting primarily of sand, gravel, and limestone slabs. There is a portion of the dam and downstream apron, that is supported on timber piling. Along the upstream face of the dam is a steel sheet pile cutoff wall. There is also a row of steel sheet piling along the toe of the apron to protect against scour. The areas supported by pile foundations are designated on Sheet No. 2 of 4 dated December 6, 1922. The piling under the dam extends for the center between buttresses Nos. 20 & 19 and extends to the vicinity of buttresses No. 13 upstream of the crest line of the dam and to the area between buttresses Nos. 11 and 12 downstream of the crest line.

2. Condition of Exterior Dam and Downstream Apron Concrete (From Visual Observation). The downstream face of the dam was viewed from the deck of the powerhouse, the top of the wall extending downstream of the powerhouse, the riverward lock wall and by walking along the top of the baffle wall across the downstream apron. The baffle wall was constructed on the apron in 1953 to induce a hydraulic jump to overcome serious scour below the dam. The baffle wall has openings to allow low flows to pass through it. The concrete is in excellent condition.

The crest of the dam and the downstream face slab were resurfaced in the period between 1949-53. Also a major portion of the apron was replaced or resurfaced before the baffle wall was constructed.

All of the concrete placed in the 1949-53 repairs appear to be in good condition. There is very little spalling and insignificant cracking. There is no indication of structural stress or differential movement.

At the time of the inspection the upstream headwater was just to the top of the 2 foot high flash boards. The flow over the flashboards was very small at the powerhouse and became progressively greater in the direction of the lock structure.

As viewed from the riverward lock wall it appeared that there has been some cavitation or spalling at the crest. However, the amount of this or seriousness could not be evaluated because of the depth and flow of water. The flashboards, while called automatic release flashboards in the 1971 report, actually are neither flashboards nor automatic. They are two foot high crest gates constructed of steel and hinged to steel anchors in the concrete. The gates, when raised, are held in place by a steel rod (clevis) connected by a turnbuckle on 8 foot centers. Each flashboard extends the length of a monolith, 16'-0" and has four sets of hinges. When lowered the gate folds in a downstream direction into a recess in the crest and water passes over it.

These gates (flashboards) are lowered when the 1/4" x 1-1/2" brass shear pins fail at a design pressure equivalent to 1 foot head above the top of gates or from ice pressure or logs against the gates. They are raised (reset) when the water level is low enough to allow the Ford Motor Company to replace the shear pins.

The resurfaced and replaced portion of the apron is in excellent condition. There is almost no cracking or spalling. The spillway apron for the left half of the dam beginning at about buttress No.

18 has not been repaired or resurfaced. The concrete has spalled and there are several cracks. Some of the "Observation Holes" in the apron slab are exposed as originally constructed. Because of high spilling flows, these holes were not probed. These holes should be inspected next year to determine if any piping or loss of foundation material through the slab has occurred. The holes should be filtered and backfilled with concrete. If a drain pipe is installed in each hole to relieve any uplift pressure there should be no adverse effort from filling these "Observation Holes". These holes are square about 2 feet on a side at the top of the slab and 1 foot on a side at the bottom of the slab. The construction drawings do not show a special filter detail at the opening under the slab. The holes are located about 20 feet downstream of the toe of the dam and are about 16 feet on centers. These observation holes were eliminated in the right half of the apron which was repaired or replaced.

At the same time that the observation holes are inspected a closer look at the left half of the apron should be taken to determine if resurfacing or replacement similar to the other half is required.

3. Condition of Sluice Gates and Operators (From Visual Observation). The eight sluice gates beneath the east end of the Dam adjacent to the Ford Powerplant were inspected on November 8, 1974, by Mr. R. L. Pfarr and Mr. B. J. Daines. The inspection was made from the catwalk extending through the buttresses of the dam. The operation of the three hydraulically actuated gates was witnessed from the catwalk. These gates were operated for us by the Ford Powerplant personnel who are responsible for the operation of the sluice.

Of the eight gates the three gates closest to the powerhouse are normally operated simultaneously by direct acting 1500 PSI hydraulic cylinders. These are powered by an electric-hydraulic pump unit located in the Ford Powerplant. All hydraulic lines and operators appear in good condition with no evidence of leaks. All gates operate smoothly with no apparent binding or difficulty. The waterward packing in the glands on the operating stem of all three gates is apparently badly worn as all three leak water into the interior of the dam.

The remaining five gates are equipped with the original hand operated gear mechanisms. These gates have not been operated for many years as evidenced by the rusted condition of the operating mechanisms. Such an extended period of disuse indicated that in all probability these gates could not be operated in their present condition. Should these gates be expected to operate in the future,

whatever silt or sand has settled against their upstream face should be removed before opening is attempted. If regular operation of these gates is desirable, operated gear mechanisms should be replaced preferably with hydraulic operators.

4. Program for Monitoring Uplift by Installation of Piezometers through Floor of Dam Structure. A program for monitoring uplift pressures beneath the dam is recommended.

Nine monitoring instruments appear to be the minimum required for adequate coverage of the site. The instruments should be installed in three rows, with three instruments per row. Each row would consist of one unit located approximately beneath the centerline of the dam, and two placed as far as possible upstream and downstream of the centerline respectively. The three rows would be located in the bay adjacent to the western-most sluice gate, a bay near the center of the dam, preferably in the section supported on wood piles, and a bay near the western quarter point of the dam.

An electrically powered drill operating from inside the dam could drill the holes required for the installations. It may be necessary to excavate varying quantities of the sand fill inside the dam to properly locate the upstream and downstream holes. The sand would be replaced after installation is complete, or the holes could be cased and the casing grouted in the concrete base slab.

Bore holed would be NX size (approximately 3 inches O.D.), and would be drilled through the concrete floor of the dam and no more than five feet into the alluvium beneath. Revert drilling mud would be used to keep the hole open in the alluvium while instruments are installed. Use of this organic mud, which completely degenerates through a controlled enzyme action, should eliminate the necessity of telescoping casing into the alluvium.

The instruments recommended for installation in these boreholes are of the gas operated, pore pressure type, such as the Hall hydrostatic Pressure Cell Number HPC-7, manufactured by Geo-Testing, Inc. This is a nitrogen filled, pneumatic system which responds to pore pressures at the point where the unit is installed. This system consists of a pressure cell, two lengths of flexible plastic tubing running from the cell to a predetermined measuring point, and a terminal facility at which measurements are made. A portable measuring console, which can be set up at each terminal facility, is required for measurement. The terminal facilities consist of a short length of capped pipe and fittings, required for hook up to the measuring console.

The procedure for installing the pressure cells in the holes involves placing the cells at the proper elevation in the alluvium, backfilling with graded sand around the instrument to the bottom of the concrete, and grouting the concrete.

The plastic tubes from each pressure cell can be run as far as necessary to the central terminal facility. Any convenient route which provides minimal protection to the tubing can be chosen. The walkway inside the dam provides the simplest route and the terminal facility can be located at the top of the stairwell leading to the river wall, or at some nearby point on the river wall. This would provide protection for the terminal facility and a convenient place for making measurements.

Instruments of this type have several advantages over other systems.

1. Each instrument is of the remote sensing type, since the terminal facilities can be as far as necessary from the measuring cell with no loss of accuracy. This is especially important at Lock and Dam No. 1. since the most critical periods occur during flood conditions when the dam itself may be at least partially filled with water. Measurements can be made under the most adverse of conditions.

2. Nitrogen filled instruments are not subject to the freezing which would make most other remote sensing systems impractical in the area of Lock and Dam No. 1. The terminal facilities require only minimal protection against weather.

3. For all practical purposes, the accuracy of these units is limited only by the accuracy of the gauges used to make measurements. Gauges provided by Geo-Testing, Inc., have accuracies of either 0.25 per cent or 0.01 per cent. It is recommended that the 0.25 percent accuracy gauge be installed.

4. Installation is simpler than many comparable remote sensing systems utilizing fluid filled, or electrical mechanisms, and is less subject to deterioration.

Estimated costs for this program are enclosed. These estimates are provided on a time and materials basis, because the greatest expense will result from the set-up on each hole in the extremely confined dam interior. Drilling expenses can be reduced if efficient methods of moving equipment inside the dam are utilized. For this reason, time and materials costs may be lower than unit price installation costs. The costs shown below are based on an estimated maximum of 24 working days for completion. Costs for a minimum of

18 working days are shown in parenthesis. Actual costs should fall in the range of these figures. Instrument costs are approximate figures provided by Geo-Testing, Inc. of San Rafael, California.

AD-A134 024 MISSISSIPPI RIVER: STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND D..(U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT APR 76 3/3

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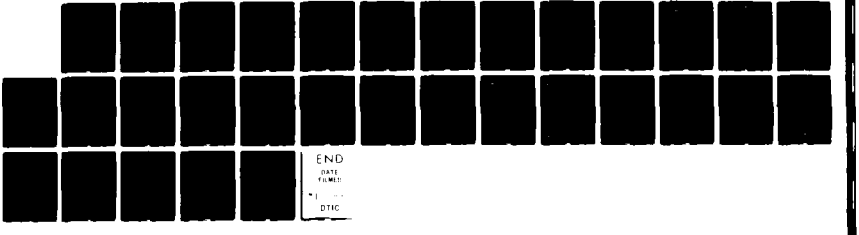

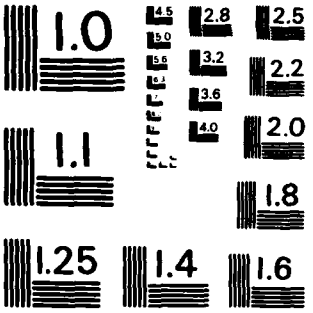

TABLE K-1

COST ESTIMATE

INSTALLATION OF PIEZOMETERS FOR MONITORING UPLIFT

ITEM	QUANTITY UNIT RATE	ESTIMATED COST maximum & minimum
Time and Materials - Drilling		
Mobilization-Demobilization	(lump sum)	$600.00 (600.00)
Set-up, drilling, installation and moving equipment	192 hrs x $45.00	8,640.00 (6,480.00)
Laborer for moving equipment and site preparation	192 hrs x $5.00	960.00 (720.00)
Expenses for drill crew	24 days x $35.00	840.00 (630.00)
Diamond bits-maximum of one per hole if large quantities of reinforcing steel are encountered (minimum of one for three holes)	9 x $250.00	2,250.00 (750.00)
Miscellaneous materials (Revert, cement, etc.)		300.00 (300.00)
Total time and materials (drilling)		13,590.00 (9,480.00)
Instrumentation		
Hall Hydrostatic Pressure Cell No. HPC-7	9 x $185.00	1,665.00
Tubing	1600 ft. x $.45	720.00
Terminal facilities	9 x $100.00	900.00
Portable monitoring console (maximum)	1 x $1,200.00	1,200.00
Geo-Testing technician to supervise installation of at least one unit	5 days x $220.00	1,100.00
Expenses for technician and travel (approx.)		575.00
		6,160.00 (6,160.00)
Total Instrumentation		
Geologist to supervise program	24 days x $250.00	6,000.00 (4,500.00)
Total Estimated Cost		25,750.00 (20,140.00)

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1210 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER

STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1

MINNEAPOLIS, MINNESOTA

APPENDIX L

COORDINATION WITH OTHER AGENCIES AND INTERESTS

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APPENDIX L

COORDINATION WITH OTHER AGENCIES AND INTERESTS

INTRODUCTION

Coordination with other agencies, including both commercial and environmental interestes, was carried out by the St. Paul District. To inform the agencies and firms, which will or could be affected by the rehabilitation of Lock and Dam No. 1, several conferences were held in the offices of the Corps of Engineers. Minutes of these meetings recording participants, discussions and comments are presented in this Appendix. Also included are copies of correspondence with various companies and agencies to record their opinions and concerns regarding the effect of rehabilitation.

NCSED-D

Conference w/ Shippers and Users - Lock and Dam No. 1 - Study of Alternatives for Rehabilitation 2 May 1975

Memo for Record

Design Branch
Engineering Division

6 May 1975
Mr. Schultz/mm/7526

1. A conference was held in the St. Paul District Office on 2 May 1975 at 10:00 a.m. with Shippers and Users of Lock and Dam No. 1.

a. To explain the results of our Phase A study of Rehabilitation.

b. To gather input from shippers and users to guide us in deciding the rehabilitation plan for L/D No. 1.

2. Persons attending the meeting and the firms they represent are as follows:

Name	Firm Representing
John Schwab	Twin City Barge & Towing Co.
Jack Hughes	Dairyland Power
Dick Doherty	Victoria Elec. Co.
Len Peterson	Valley Line
Connie Jacobs	Capitol Barge Service
Don Wagner	NSP
Gary Well	NSP
Jim Wicks	J. Wicks & Assoc.
Jim Weyandt	Bolander-Canlan
Dave Sorensen	General Mills, Inc.
Dendio	General Mills, Inc.
J. F. Shiely	J. L. Shiely Co.
Charles E. Workman	Corps of Engineers, Economics Sec.

3. Bill Goetz gave a brief welcome to the attendees and introduced Mr. Schultz - L & D No. 1 Project Manager for the presentation. Mr. Schultz handed out the outline of his talk along with the enclosures so that participants would have factual data to take back to their respective offices. (Incl. 1) The basic information furnished the participants was as follows:

a. The purpose of the meeting, to gather input from shippers and users.

b. The reason for the study, the structure will require extensive maintenance if major rehabilitation is not done.

NCSED-D 6 May 1975
SUBJECT: Conference with Shippers and Users - Lock and Dam No. 1 - Study of Alternatives for Rehabilitation 2 May 1975

c. Outline of the study.

d. A six min. movie was shown of the lock chamber during filling and of the lower channel approach during emptying to give participants an idea of the excessive turbulence which exists.

e. The four basic questions which the Corps must answer at the completion of the report were presented.

1) Should we rehab the L-lock only.

2) Should we rehab both locks.

3) Can we perform work without restricting navigation.

4) If we must restrict navigation, which plan will create the least impact on the users.

4. Following the enclosed outline, the results of the Phase A report were covered in greater detail. The participants were told that the study had shown that in all plans it would be necessary to shut the lock down for 5 months during the winter because the cofferdam requirements for all plans will be the same. Therefore, the basic choice was between Plan 1 and Plan 4. After all information had been presented, the meeting was opened up for discussion. Typical questions asked were:

a. What assurance do we have that lock will be closed down for only five months?

Answer: The government will order and have on hand all operating machinery, sheet piling and critical items before awarding the construction contract. The five months working period is based on 2-10 hour shifts per day. If the contractor falls behind he will be required to work 24 hours a day. Lock chamber will be covered to shield the area from the weather thereby increasing the workers efficiency.

b. When would the work be started?

Answer: 1 July 1977 is the soonest we could begin. This is because a model test must be run to confirm preliminary design concept, final design must be completed after model tests are complete and operating equipment ordered and delivered prior to beginning work.

NCSED-D 6 May 1975

SUBJECT: Conference with Shippers and Users - Lock and Dam No. 1 Study of Alternatives for Rehabilitation 2 May 1975

5. The grain shippers expressed preference for closing the lock to navigation on 1 December instead of 1 November. November is a heavy shipping month for them because the corn and soybean crops from the farmers do not arrive at the terminals until the middle of Oct to middle Nov. The coal users on the other hand prefer early opening of the lock on 1 March as they are running short on their winter supply of coal at that time and need to replenish their stockpiles.

6. Mr. Schultz suggested the participants return to their offices, think about the impact of closing down the lock for five months and send a letter to Mr. Goetz by 12 May 1975 expressing their views as to which situation presents the least impact on their operation.

7. Meeting was adjourned at 11:20 a.m.

1 Incl
as

JOSEPH SCHULTZ, JR.
PROJECT MANAGER, Lock and Dam No. 1

CF:
CO Goetz
Taggatz, CO
Workman, ED-PB

Conference With Shippers and Users
L/D #1 - Study of Alternatives for Rehabilitation
2 May 1975

I. Introduction

A. Purpose of Meeting

1. To explain the results of our Phase A study of rehabilitation.

2. To gather input from shippers and users to guide us in deciding rehabilitation plan for L/D #1.

B. Reason for Study

1. Locks do not meet present criteria for stability.

2. Machinery is antiquated and needs replacement.

3. Concrete surfaces have deteriorated and need repairing.

4. Filling, emptying, and venting system is inadequate, resulting in excessive turbulence in lock chambers and in channel immediately downstream.

C. Outline of Study

1. Phase A study and report - Study of 4 alternatives for rehabilitation.

a. Plan 1: Rehabilitation of landward lock without interruption of navigation.

b. Plan 2: Rehabilitation of landward lock with temporary use of riverward lock for navigation.

c. Plan 3: Rehabilitation of landward lock with navigation closed during construction.

d. Plan 4: Rehabilitation of both locks without interruption of traffic.

2. Preparation of site topography.

3. Foundation, exploration, and laboratory testing.

D. Movie of turbulence in lock chamber and immediately downstream. Filling both culverts - taken from lower miter gate; emptying both culverts - taken from lower miter gate and lower right wall rock dike.

E. Questions resulting from study.

1. Should we rehabilitate L-lock?

2. Should we rehabilitate both locks?

3. Can we perform work without restricting navigation?

4. If we must restrict navigation, which plan will create the least impact?

II. Extent of Investigation (Incl. 1)

A. Modifications Recommended (Plate 7((Incl, 2)

B. Schedule of Design and Construction (Incl.3)

Cofferdam Plates E-1 (Incl. 4) and E-2 (Incl. 5).

III. Phase B - Study of Recommended Plan

A. Model study will be performed.

B. Detailed Study of Selected Plan

1. Design

2. Schedule of construction

3. Cost

IV. Construction Plans

A. Design Machinery and Valves by 1 July 1976

B. Order Government-Furnished Equipment

1. Filling valves

2. Emptying

3. Miter gate and valve operating machinery

4. Steel sheet piling

C. Prepare Construction Plans and Specifications by 1 June 1977

D. Advertise and Award Construction Contract by 1 July 1977.

E. Two Years for Construction.

V. Summary

Having studied the alternatives, we must now decide on a plan of rehabilitation to study in detail in Phase B.

VI. Group Discussion

a. Should we rehabilitate L-lock?

b. Should we rehabilitate both locks?

c. Can we perform work without restricting navigation?

d. If we must restrict navigation, which plan will create the least impact?

VICTORIA ELEVATOR COMPANY

ESTABLISHED 1889

May 7,1975

Mr. Bill Goetz
St.Paul District Corps of Engineers
Construction Operations Branch
1135 U.S.Post Office Bldg.
St.Paul,Minn. 55101

Dear Mr. Goetz:

As requested at the May 2,1975 meeting in St.Paul, Victoria Elevator Co. would like to go on record as their views regarding the repair of Lock & Dam #1.

Victoria Elevator Company moves approximately 250,000 tons annually from their Port Victoria Elevator in the Upper Harbor thru Lock & Dam #1 to Gulf Port Markets. We also custom load barges for other firms such as: Pillsbury Co, Peavey Co.,Cargill Inc.,Minnesota Linseed, I.S.Joseph, Ocomco and McMillan Co.

Harvest season (October & November) is very important to us and our 400-500 producer customers. We would suggest that the project be time-tabled to permit navigation thru November with work to be completed by May 1st the following year. The loss of April is not as severe as the loss of November for the availability of river navagation.

As our company employs about 20 people and 75% of our earnings are dependent on river navagation, we strongly urge the Corps of Engineers to select a plan that will permit navagation thru November.

Very truly yours,

VICTORIA ELEVATOR COMPANY

R.T.Doherty

lbc/rtd

NSP

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

May 13, 1975

Mr W L Goetz
Dept of the Army
St Paul Corps of Engineers
1210 Post Office Building
St Paul, Minnesota 55101

Dear Bill

This response is in regard to your request for comments on the alternative plans for rehabilitation of Lock and Dam 1.

Due to our critical need to continue the temporary transloading of western coal from trains to barges in the Minneapolis upper harbor until such time as a permanent transloading facility is completed, we urge the Corps to adopt Plan 4 which provides for rehabilitation of both locks without interruption of navigation. Rehabilitation of both locks should provide for an increase in the number of vessels locked through, both recreational and commercial. This is considered important since reliance of western coal for our Black Dog Plant will be increasing in the next few years as less Illinois coal is available.

We concur in the recommendation made at the meeting of May 2 regarding the closing of the locks from December through April instead of November through March.

Our concern to preserve the upper harbor transloading capability is emphasized by our commitment to comply with applicable air quality regulations. These regulations require that sulfur in fuel shall not exceed 1.5% within the seven county metropolitan area. Since direct rail delivery of low sulfur western coal to our Black Dog and A S King Plants is not possible, barge deliveries must be maintained.

The present transloading program has enabled NSP to achieve compliance with air quality requirements at Black Dog as of November 1, 1974. In order to remain in compliance, NSP must maintain a multi-terminal rail-to-barge transloading capability until a permanent facility is available.

If you have any questions regarding these comments please let me know.

Sincerely

V H Wood
Manager of Fuel Procurement

By D W Wagner
D W Wagner, Administrator
Fuel Transportation & Services

88

c: G V Welk
Joe Bizzano

NCSED-ER

22 May 1975
ANFANG/jp/5936

Mr. Jack Hemphill
Regional Director
U.S. Fish & Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Dear Mr. Hemphill:

We are currently investigating alternative proposals for the rehabilitation of Lock and Dam Number 1. The structure is 40 years old and requires intensive maintenance, including resurfacing of the locks due to the deterioration of the concrete surface. The purpose of the study is rehabilitation of the structure and replacement of operating machinery to extend the life of the structure another 40 years.

Studies to date have been aimed at evaluating the general feasibility and desirability of rehabilitating the structure and also at choosing among several general alternatives, e.g., closing the locks until work is completed versus working only during the winter. We are about to select among the alternatives and to begin the detailed studies necessary to implement the selected plan.

We plan to conduct a coordination meeting on alternatives on 5 June 1975 at 1:30 p.m. in room 1515 of the U.S. Post Office and Custom House in St. Paul. We would like to have your agency represented at this meeting to assure full coordination. This meeting would provide a forum for informal discussion of the rehabilitation project and an opportunity for us to obtain your views on alternatives. If you have any questions please contact Mr. Joseph Schultz at 725-7526.

Sincerely yours,

1 Incl
Identical ltrs list

MAX W. NOAH
Colonel, Corps of Engineers
District Engineer

CF:
Joseph Schultz

NCSED-ER | Lock and Dam #1 Rehabilitation. 5 June Meeting with Federal and State Agencies

Memo for Record | Environmental Resources Branch | 20 June 1975 ANFANG/cz/5936

1. On Thursday, 5 June 1975 Dr. Peter Ames, Head of the Environmental Studies Department of Harza Engineering Company, Chicago, Ill, came to the St. Paul District Office from 8:30 a.m. to 11:00 a.m. On 5 June Dr. Ames and the undersigned observed the Lock and Dam No. 1 area and the proposed staging area near the Ford Motor Company Steam Plant. The following points were discussed and/or observed:

a. Dr. Ames agreed that transplanting elms would be impractical.

b. Dr. Ames noted that the area was much more wooded than he had expected and the island, although of little ecological significance, does aesthetically add to the area. He also said that the engineers at Harza probably are using the island as a staging area mostly out of convenience.

c. I mentioned that the outlet structure for the river wall discharges in the proposed plan (Plate 11 of Phase A report) is pointed directly at the island which is about 50 feet away. Dr. Ames agreed that flow from this structure could cause severe erosion to the island but he did not state if the plans would be changed. This should be investigated during on-going studies.

d. Some birds that were observed in the area include: night heron; mallard ducks; killdeer; spotted sandpiper swallow; and tern. Dr. Ames, who has a background in Ornithology stated that some of these birds have nests in the construction area.

e. The narrow channel between the island and lock would be filled. The engineers at Harza were comtemplating using material on the north end of the island for fill. It is doubtful if enough material is present on this portion of the island.

f. Dr. Ames agreed that more information is needed on the wildlife, vegetation, and human use of the area.

g. The proposed mainland staging area near the steam plant of Ford Motor Company consists of three high terraces between the river and Mississippi River Boulevard. The road into the area is steep and has a sharp turn at the bottom.

NCSED-ER 20 June 1975
Subject: Dock and Dam #1 Rehabilitation. 5 June 1975 Meeting with Federal and State Agencies.

A new access road would have to be constructed near the bottom of the hill and the proposed staging area cleared of about five 12-inch trees plus some sampling. The amount of clearing required would depend on the size of the staging area. The soil in the area consists mainly of clay but there is a considerable amount of concrete, asphalt, and steel debris. The side slopes of the entrance road to the stream plant are sloughing and the banks are eroding. The area down river is wooded parkland, floodplain, or steep bluffs.

3. We returned to the office about 11:00 a.m. and reviewed the morning activities with Roger Lake (ED-ER). The discussion centered around the staging areas, drainage facilities, and removal of construction debris during the work.

4. We also met with Edward McNally (ED-ER) and Frank Mazurkiewicz (CO-PO), from whom Dr. Ames obtained more information concerning use of the Lock area by fishermen for use in future reports by Harza Engineering Company.

5. At 1:30 p.m. an interagency coordination meeting was held with the following agencies:

Minnesota Pollution Control Agency
Environmental Protection Agency
Harza Engineering Company of Chicago
Corps of Engineers

The Minnesota Department of Natural Resources and U.S. Fish and Wildlife Service, who had been requested to attend the meeting, were not represented. Those attending the meeting are listed on the attached attendance sheet.

6. Mr. Schultz began by explaining the results of the Phase A Study including the need for the project and a description of the structural plan. I described the studies which we feel are necessary to be conducted during Phase B of the project investigation.

7. A discussion period followed. The following points were considered.

a. Mr. Boseke of the EPA stated that he would like to see the island not be used as a staging area, but realizes that there are also economic considerations and that it may be necessary to use the island. I stated that we are having Harza look into the feasibility of not using the island and that a final decision will be made at a later date.

b. I stated that the wildlife, vegetation, and human use of the island and mainland staging area will be studied. There was general agreement on this point.

c. I stated that the aquatic ecosystems of the river would be studied, including the location of spawning areas and fish resources of the river. There was no comment on this because this subject is of more interest to the Minnesota DNR and the U.S. Fish and Wildlife Service.

d. I stated that I wanted the opinion of the MPCA and US-EPA on the necessity of monitoring the water quality of the drainage waters from within the cofferdam perimeter. Mr. Schultz and Mr. Lake added that the construction contract would contain provisions for the continuous cleanup of debris and that a flocculation system could be employed to help settle the chemicals and pollutants out of the drainage water before it is pumped back into the river. Mr. Bedeke stated that he did not believe that it would be necessary to monitor the water quality but he did add that a boom could be used to collect any oil that may enter the river. The question was raised as to the necessity of a NPDES permit under Section 13 of the 1899 River and Harbor Act. The possible need for such a permit was not determined.

e. The next point I brought up was that the Corps was going to analyze sediment samples for various chemical parameters. Bottom samples will also be obtained for the purpose of enumerating the number and kinds of benthic invertebrates. They would also be identified for their tolerance to organic pollution. There was no adverse response to this.

f. The MPCA and MSB have taken water samples in the Mississippi River. Harza has been asked to present these in future reports. Mr. Beseke stated that the EPA has monitored water quality for a 10 day period in August at the dam and that we could use these data if we wanted to.

g. The statement was made that the MPCA should be contacted to determine the requirements for the water quality permits or monitoring requirements.

h. Concern was also voiced over the possibility of noise and air pollution, especially because the construction area is near the Veterans Home.

NCSED-ER 24 June 1975
Subject: Lock and Dam #1 Rehabilitation. 5 June 1975 Meeting with Federal and State Agencies.

9. On 10 June I contacted Mr. Joe Scott of the U.S. Fish and Wildlife Service. I described the proposed project and studies which we are planning for Phase B. Mr. Scott said he would contact me again and submit his comments in a letter. He did say that the MPCA should be contacted for requirements for drainage water discharge.

Mr. Scott also stated that debris removal and a settling basin for seepage water would be needed. He also stated that revegetation or reseeding of the mainland staging area and island staging area, if it is used, should be conducted. Mr. Scott agreed that most environmental impacts would result from placement and removal of fill in the channel between the island and lock and the placement and removal of the cofferdams. Mr. Scott also brought up the possibility of using dredge material for fill.

10. On 13 June 1975 I had a telephone conversation with Mr. David Meppen of the Minnesota Department of Natural Resources, Division of Waters. I described the project and the stature of the proposed action believing that monitoring of drainage waters would be needed but he did say that the MPCA should be contacted to obtain their regulations. Mr. Meppen noted that some type of system would be needed to remove oil from the drainage water before it is pumped back into the river. Mr. Meppen mentioned that the Corps might have to obtain a permit from the DNR changing the current or cross section of public waters. He said he was going to talk with other people in the Division of Waters concerning this. I talked with Frank Ryder (CO-S) about this and he did not think a permit would be required. Mr. Meppen said he was going to discuss the rehabilitation of Lock and Dam No. 1 with other people in the Division of Waters and let me know if there are any more comments.

CF:
Joe Schultz

ROBERT ANFANG
Forester
Environmental Resources
Branch

5 June 1975

ATTENDANCE LIST

NAME	AGENCY
John R. Hotvet	Minn. Pollution Control Agency
Keith Beseke	U.S. EPA
Roger Lake	Corps of Engineers
Robert Anfang	Corps of Engineers
Peter L. Ames	Harza Engineering Co.
Alfred H. Mathews	Lock and Dam No. 1
Joseph Schultz	Corps of Engineers

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

REFERENCE OR OFFICE SYMBOL	SUBJECT
NCSED-D	Conference with State of Minnesota DNR & U.S. Fish & Wildlife - Lock and Dam No. 1 - Study of Alternatives for Rehabilitation 8 July 1975

TO Memo for the Record FROM Design Branch DATE 11 July 1975 CMT 1
Mr. Schultz/ach/7526

1. A conference was held in the St. Paul District Office on 8 July 1975 at 10 a.m. with representatives of the State of Minnesota DNR and U.S. Fish & Wildlife Service. The purpose of the meeting was twofold:

a. To explain the results of our Phase A study of Rehabilitation.

b. To gather input from Environmental agencies to guide us in designing the rehabilitation plan for L/D No. 1.

2. Persons attending the meeting and the firms they represent are as follows:

Name	Firm Representing
Dennis Chase	U.S. Fish & Wildlife Service
Authur Peterson	DNR Fish & Wildlife
Milt Krona	DNR Parks & Recreation
Larry Seymour	DNR - Waters
Robert Anfang	Corps of Engineers
David Meppen	Division of Waters
Don Buckhout	DNR - Planning
Joe Schultz	Corps of Engineers

3. Mr. Schultz - L&D No. 1 Project Manager gave the presentation. Mr. Schultz handed out the outline of his talk along with the inclosures so that participants would have factual data to take back to their respective offices. (Incl. 1) The basic information furnished the participants was as follows:

a. The purpose of the meeting; to gather input from environmental agencies.

b. The reason for the study; the structure will require extensive maintenance if major rehabilitation is not done.

c. Outline of the study.

d. The four basic questions which the Corps must answer at the completion of the report were presented.

(1) Should we rehab the L-lock only.

(2) Should we rehab both locks.

(3) Can we perform work without restricting navigation.

NCSED-D 11 July 1975
SUBJECT: Conference with State of Minnesota DNR & U.S. Fish & Wildlife - Lock and Dam No. 1 - Study of Alternatives for Rehabilitation 8 July 1975

(4) If we must restrict navigation, which plan will create the least impact on the users.

4. Following the inclosed outline, the results of the Phase A report were covered in greater detail. The participants were told that the study had shown that in all plans it would be necessary to shut the lock down for 5 months during the winter because the cofferdams requirements for all plans will be the same. Therefore, the basic choice was between Plan 1 and Plan 4. After all information had been presented, the meeting was opened up for discussion. Typical questions asked were:

a. When would the work be started?

Answer: 1 July 1977 is the soonest we could begin. This is because a model test must be run to confirm preliminary design concept, final design must be completed after model tests are complete and operating equipment ordered and delivered prior to beginning work.

b. Will lock be changed so as to accommodate deeper draft barges?

Answer: No. River lock will take 7' draft barges and L& Lock, 9' draft barges @ normal lower prop elevation.

5. Mr. Schultz suggested the participants return to their offices, think about the impact of rehabilitating the lock and send a letter to Colonel Noah by 23 July 1975 expressing their views as to what investigations should be made in Phase B to insure adequate consideration of environmental matters. Some suggestions for items to examine during Phase B are as follows:

a. Duane Shodeen - Regional Fish Manager - wants fishing pier or barge or safe place to fish from 300 D. S. of Lock so there is no excuse for fishermen to go into dangerous water.

b. Mr. Krona - look at recreation use of staging area on east bank of river after construction is complete.

c. Look at possibility of providing a portage for canoes so they don't have to use lock.

d. Look at means of providing safe approach for small craft from upper end so they aren't swept over the dam.

e. Hold public meeting during Phase B to get input from recreation users and marina operators.

NCSED-D 11 July 1975
SUBJECT: Conference with State of Minnesota DNR & U.S. Fish & Wildlife - Lock and Dam No. 1 - Study of Alternatives for Rehabilitation 8 July 1975

f. Look at possibility of long horizontal floating mooring bit for a number of small boats to anchor to during filling.

7. Meeting was adjourned at 11:20 a.m.

Joseph Schultz, Jr.

1 Incl
as

JOSEPH SCHULTZ, JR.
Project Manager
Lock and Dam No. 1

CF:
Chief, Environ Res Br

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:

ES-FWP

JUL [illegible] 1975

Colonel Max W. Noah
District Engineer
U. S. Army Engineer District
St. Paul
1210 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Noah:

This is in response to your request of July 8, 1975 for our views on the rehabilitation of Lock and Dam #1, Mississippi River.

Several studies have been proposed by your Environmental Branch to determine impacts on existing resources. We suggest the following items be included in these investigations:

1. A small, partially vegetated area along the outside of the riverward lock will be destroyed by the steel cofferdam and access road. Potential fish and wildlife losses should be determined.

2. The feasibility of providing pedestrian access and small boat launching facilities above and below the dam should be investigated.

3. As suggested by the Minnesota Department of Natural Resources, the feasibility of providing a fishing pier or barge below the dam should be investigated.

4. We understand that a storage area for construction materials may be necessary along the eastern shore and downstream from the lock and dam. Probable impacts on fish and wildlife resources resulting from such use of this area should be determined. Perhaps this area could be developed for public use after construction, including boat launching and fisherman access. Such development in an area where few such facilities exist would be especially valuable.

We appreciate the opportunity to comment on this project in its early planning stage. Please keep us advised of your study progress and plans concerning the rehabilitation of Lock and Dam #1.

Sincerely yours,

Acting Regional Director

cc: Commissioner, Minnesota DNR, St. Paul

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1210 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

MISSISSIPPI RIVER

STUDY OF ALTERNATIVES FOR REHABILITATION OF LOCK AND DAM NO. 1

MINNEAPOLIS, MINNESOTA

APPENDIX M

RECREATION USER SURVEY

TABLE OF CONTENTS

PLATES

APPENDIX M

RECREATION USER SURVEY

Introduction

1. A recreation user survey was conducted on ten sample days during the summer of 1975 at Lock & Dam No. 1 on the Mississippi River in Minneapolis, Minnesota. The objective of the study was to evaluate recreational activity in the vicinity of Lock and Dam No. 1 so that the effects of lock rehabilitation work on recreational users along this reach of the river could be determined.

Procedure

2. Ten sample days were selected so that the survey included every day of the week, a national holiday and two days after Labor Day. The dates sampled, as well as river and weather conditions on those dates, are given below:

Sample Date	River Condition	Weather
2 July 1975	5 feet above normal, water currents strong and rough.	Cloudy am, to partly cloudy pm, temperature 80 degrees.
12 July 1975	4.5 feet above normal.	Clear and warm, strong winds, temperature 75 degrees.
25 July 1975	Normal	Hot and humid, temperature 90 degrees.
5 Aug. 1975	Normal	Frequent rain showers, clearing in afternoon, temperature 70 degrees.
18 Aug. 1975	Normal	Overcast am, hazy pm, temperature 68 degrees.
24 Aug. 1975	Normal	Hot and humid.
28 Aug. 1975	-	Tornado warnings and rain all day.

Sample Date	River Condition	Weather
1 Sept. 1975	1 foot below normal	Cloudy am, clearing pm to cloudy late pm.
6 Sept. 1975	Slightly below normal	Cloudy am, partly cloudy pm.
10 Sept. 1975	Slightly above normal	Light showers am, fair to partly cloudy pm.

3. Sampling was conducted between 7:00 am and 6:00 pm on the first five sample days. On the later five sample days the survey was extended to 8 pm as it was observed that many people boated into the later evening hours. The limits of the area sampled extended approximately 1500 feet up and downstream of Lock and Dam No. 1, as shown on Plate M-1.

4. Observations including number of boaters, people per boat, type of boat and their movements were recorded on data sheets of the type illustrated by Plate M-2. Two observers were used on each sample day. One observer recorded users in the upper pool while the other observer recorded users of the lower pool.

Observations

5. It was observed that few recreational users arrived at the upper or lower pools in the early morning. Many users, however, stayed in the area into the later evening between 6 pm and 8 pm. Throughout the survey, people would dock their boats on the island below the dam to fish and picnic. It was noticed that many people would also stop at the island because they could not lock through at the moment they arrived. Sometimes boaters would stay on the island for 2 or 3 hours and some would dock and fish all day. On Labor Day there were 13 boats docked on or near the island at one time, and 11 people were still fishing at 8:00 pm.

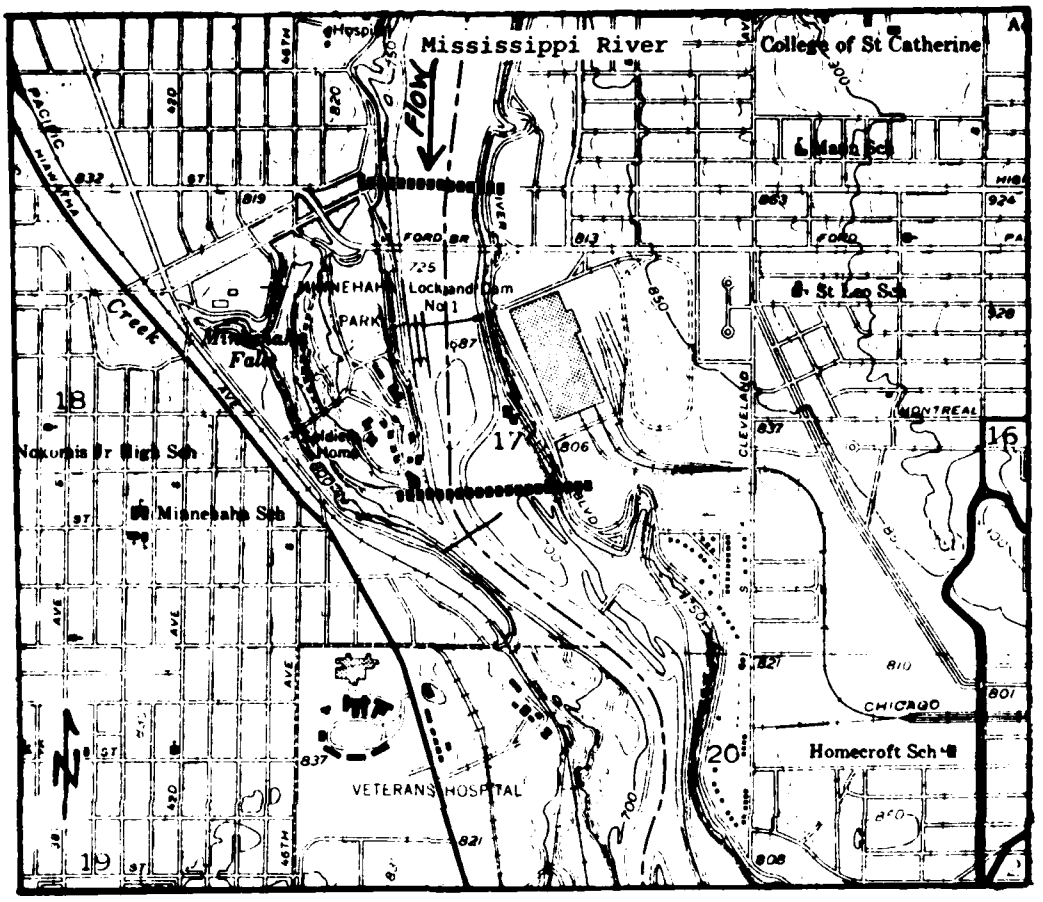
6. Some boaters would enter and leave the survey area several times, hoping to find a time when they could conveniently lock through. Most of the time barge traffic was already waiting, which caused many recreational users to return downstream rather than wait to lock through.

Results

7. The recreation user survey indicated that approximately 10,600 people, accounting for an aggregate 2,500 visitor days, use this river reach during the summer months. Although observations of hours spent fishing were made on only six of the ten sample days, the data indicate that 1800 to 2100 people spent an additional 600 to 700 visitor days during the summer fishing in the study area. The island below the dam receives considerable use from boaters who stop to fish or picnic, or to wait for a time when they can lock through.

8. Boating uses of the upper and lower pools at Lock and Dam No. 1 are summarized in Table M-1. Hourly summaries of boating activity are included as Plate M-3. Fishing activity for six sample days is summarized in Table M-2.

9. A projection to determine the numbers of boats and people in the sample area was made for the hours 7 pm and 8 pm. The projection is based on a weighted average of sample data obtained for those hours on five of the ten sample days.



SCALE 1:24000

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

LEGEND:

Approximate Limits
of Sampled River Reach

SYMBOL	DESCRIPTION	DATE	APPROVAL
HARZA ENGINEERING COMPANY CHICAGO, ILLINOIS		DEPARTMENT OF THE ARMY ST PAUL DISTRICT CORPS OF ENGINEERS ST PAUL, MINNESOTA	
DESIGNED BY S.O.S.	STUDY OF ALTERNATIVES FOR REHABILITATION MISSISSIPPI RIVER LOCK & DAM NO. 1		
DRAWN BY D.R.B.	RECREATION USER SURVEY		
CHECKED BY J.T.P.	LOCATION MAP		
SUBMITTED BY:			
APPROVED:		DATE: MARCH 1975	
		SCALE	DRG. NO.
		DRAWING NUMBER	
		SHEET OF	

SAFETY PAYS

PLATE M-1

LOCK AND DAM No. 1 Recreational Use Survey 1975 Date _____

Observer _____

Sample Location _____

TIME	NO. OF BOATS	PEOPLE PER BOAT	TYPE OF BOAT
0700			
0800			
0900			
1000			
1100			
1200			
1300			
1400			
1500			
1600			
1700			
1800			

HECo 6/75

Plate M-2

1975 RECREATION USER SURVEY SUMMARY
LOCK & DAM NO. 1
UPPER POOL OBSERVATIONS OF BOATS

	Tue 2 July	Sat 12 July	Fri 25 July	Tue 5 August	Mon 18 August	Sun 24 August	Thur 28 August	Holiday 1 Sept.	Sat 6 Sept.	Wed. 10 Sept.	TOTAL PER HOUR
700 AM											
	0	0	0	-	-	2	-	-	-	-	2
800											
	0	0	0	2	0	2	-	1	0	0	5
900											
	1	0	1	0	0	2	-	3	0	0	7
1000											
	1	2	1	2	0	1	-	3	0	0	10
1100											
	1	2	0	0	0	2	-	3	0	0	8
1200											
	0	2	0	1	2	4	-	5	8	1	23
100											
	2	4	1	0	0	6	-	13	0	0	26
200											
	0	5	1	9	0	10	-	4	0	0	29
300											
	3	15	1	0	4	8	-	3	4	0	38
400											
	3	5	2	0	2	10	-	3	5	0	30
500											
	5	7	6	9	2	3	-	6	5	0	43
600											
	1	3	1	2	1	2		3	2	0	15
700											
	1	1	0	0	0	1		1	0	0	4
800 PM	—	—	—	—	—	—	—	—	—	—	—
TOTAL 700 AM-800 PM	18	46	14	25	11	53	0	48	24	1	240

1975 RECREATION USER SURVEY SUMMARY
LOCK & DAM NO. 1
UPPER POOL OBSERVATIONS OF PEOPLE

	Tue 1 July	Sat 12 July	Fri 25 July	Tue 5 Aug.	Mon 18 Aug.	Sun 24 Aug.	Thur 28 Aug.	Holiday 1 Sept.	Sat 6 Sept.	Wed 10 Sept.	TOTAL PER HOUR
700 AM											
	0	0	0	-	-	10	-	-	-	-	10
800											
	0	0	0	7	0	4	-	2	0	0	13
900											
	6	0	7	0	0	5	-	12	0	0	30
1000											
	3	7	2	10	0	4	-	7	0	0	33
1100											
	2	8	0	0	0	6	-	13	0	0	29
1200											
	0	12	0	2	5	17	-	16	25	2	79
100											
	9	15	4	0	0	20	-	54	0	0	102
200											
	0	21	4	27	0	44	-	18	0	0	114
300											
	14	63	2	0	12	26	-	15	18	0	150
400											
	10	18	8	0	9	37	-	9	16	0	107
500											
	23	25	21	27	7	15	-	20	18	0	156
600											
	4	12	4	5	3	8		11	5	0	52
700											
	3	5	1	2	0	6		6	2	0	25
800 PM	—	—	—	—	—	—	—	—	—	—	—
TOTAL 700 AM - 800 PM	74	186	53	80	36	202	0	183	84	2	900

1975 RECREATION USER SURVEY SUMMARY
LOCK & DAM NO. 1
LOWER POOL OBSERVATIONS OF BOATS

	Tue 2 July	Sat 12 July	Fri 25 July	Tue 5 Aug/	Mon 18 Aug.	Sun 24 Aug.	Thur. 28 Aug.	Holiday 1 Sept.	Sat 6 Sept.	Wed 10 Sept.	TOTAL PER HOUR
700 AM											
	0	0	0	-	-	-	-	3	-	-	3
800											
	0	0	0	2	0	4	0	2	3	2	13
900											
	1	0	1	0	0	3	0	7	0	0	12
1000											
	0	3	1	2	1	1	0	8	5	0	21
1100											
	1	9	6	2	0	3	0	12	9	1	43
1200											
	0	10	5	0	3	7	0	9	5	1	40
100											
	2	8	3	10	0	15	0	12	5	1	56
200											
	0	12	2	2	4	8	0	15	4	0	47
300											
	4	14	9	1	4	7	0	14	14	0	67
400											
	3	13	9	3	0	15	0	11	10	2	66
500											
	8	16	7	11	5	12	0	19	6	0	84
600											
	2	9	5	3	2	8	0	18	5	4	56
700											
	2	10	7	4	2	10		9	9	1	54
800 PM	—	—	—	—	—	—	—	—	—	—	—
TOTAL 700 AM - 800 PM	23	104	55	40	21	93	0	139	75	12	562

1975 RECREATION USER SURVEY SUMMARY
LOCK & DAM NO. 1
LOWER POOL OBSERVATIONS OF PEOPLE

	Tue 2 July	Sat 12 July	Fri 25 July	Tue 5 Aug.	Mon 18 Aug.	Sun 24 Aug.	Thur 28 Aug.	Holiday 1 Sept.	Sat 6 Sept.	Wed 10 Sept.	TOTAL PER HOUR
700 AM											
	0	0	0	-	-	-	-	10	0	-	10
800											
	0	0	0	7	0	8	-	5	6	5	31
900											
	6	0	7	0	0	8	0	20	0	0	41
1000											
	0	8	5	5	3	4	0	32	14	0	71
1100											
	2	37	21	7	0	10	0	53	32	4	166
1200											
	0	35	19	0	19	27	0	27	18	2	147
100											
	9	32	12	26	0	54	0	44	18	2	197
200											
	0	43	12	4	15	28	0	62	12	0	176
300											
	22	65	29	2	7	26	-	59	52	0	262
400											
	11	48	36	7	0	53	-	37	26	6	224
500											
	29	57	29	31	10	60	-	72	23	0	311
600											
	10	39	20	11	7	31		73	31	14	236
700											
	9	38	27	11	6	44		32	29	4	200
800 PM	—	—	—	—	—	—	—	—	—	—	—
TOTAL 700 AM - 800 PM	98	402	217	111	67	353	0	526	261	37	2072

END

DATE
FILMED

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DTIC